PHYSICS (PHYS)

PHYS 1010 - Physics and the World Around Us
Credit(s): 3 Credits
Basic concepts of physics emphasizing the meaning of modern developments of the science. High school mathematics required. Fulfills three credit hours of the general science requirement. For non-science majors; does not apply toward the area of concentration with a major in physics.
Attributes: Natural Science Req (A&S)

PHYS 1015 - Physics and the World Around Us
Credit(s): 3 Credits
Basic concepts of physics emphasizing the meaning of modern developments of the science. High school mathematics required. Fulfills three credit hours of the general science requirement. For non-science majors; does not apply toward the area of concentration with a major in physics.
Attributes: Prof. Studies Students Only

PHYS 1050 - Intro to Physics of Human Body
Credit(s): 3 Credits
Discusses the physics of certain aspects of the working of the human body. Fulfills three credit hours of the general science requirement. Primarily for non-science major in physics.
Attributes: Natural Science Req (A&S)

PHYS 1110 - Introduction to Physics
Credit(s): 1 Credit
Broad survey of physics. Introduction to computational and laboratory methods. Enrollment limited to students majoring in physics.
Attributes: Natural Science Req (A&S)

PHYS 1130 - Introduction to Astronomy
Credit(s): 1 or 3 Credits
Modern concepts of the physical nature of the astronomical universe. Fulfills three credit hours of the general science requirement. For non-science majors; does not apply toward the area of concentration with a major in physics.
Prerequisite(s): (1 Course from MATH 120-4999 or Math Waiver per Advisor with a minimum score of 1200)
Attributes: Natural Science Req (A&S)

PHYS 1150 - Einstein's Universe
Credit(s): 3 Credits
The life and science of Albert Einstein and his multi-faceted impact on modern physics and society is explored. Primarily for non-science majors, may be taken as allied elective by physics majors.
Attributes: Natural Science Req (A&S)

PHYS 1220 - General Physics I
Credit(s): 0 or 4 Credits
Lectures, demonstrations, and laboratory in mechanics and heat. (Offered every Fall)
Restrictions:
Enrollment limited to students in the Doisy College Health Sciences college.
Attributes: Natural Science Req (A&S)

PHYS 1240 - General Physics II
Credit(s): 0 or 4 Credits
Lectures, demonstrations and laboratory in electricity, magnetism, wave motion, sound, optics and modern physics. (Offered every Spring)
Prerequisite(s): PHYS 1220
Restrictions:
Enrollment limited to students in the Doisy College Health Sciences college.
Attributes: Natural Science Req (A&S)

PHYS 1310 - Physics I
Credit(s): 3 Credits
Lectures and demonstrations in mechanics and heat. PHYS 1320 should be taken concurrently with PHYS 1310. (Offered every Fall)
Prerequisite(s): (MATH 1200, 1 Course from MATH 1410-4999, or MATH 1400)
Corequisite(s): PHYS 1320
Attributes: Natural Science Req (A&S)

PHYS 1320 - Physics I Laboratory
Credit(s): 1 Credit
Laboratory in mechanics and heat. (Offered every Fall)
Corequisite(s): PHYS 1310
Attributes: Natural Science Req (A&S)

PHYS 1330 - Physics II
Credit(s): 3 Credits
Lectures and demonstrations in electricity, magnetism, wave motion, sound, optics and modern physics. (Offered every Spring)
Prerequisite(s): PHYS 1310
Corequisite(s): PHYS 1340
Attributes: Natural Science Req (A&S)

PHYS 1340 - Physics II Laboratory
Credit(s): 1 Credit
Laboratory in electricity, magnetism, wave motion, sound, optics and modern physics. (Offered every Spring)
Corequisite(s): PHYS 1330
Attributes: Natural Science Req (A&S)

PHYS 1350 - Aviation Physics
Credit(s): 0 or 4 Credits
Units and measurement; vectors; force and motion; energy; momentum; gravitation; forces of drag and lift; rotational motion; equilibrium of forces during flight; harmonic motion; selected topics in fluid mechanics and thermodynamics; electricity; electrical energy; magnetism; electromagnetic induction; linear and wave optics; atmospheric optics; laboratory experiments relating to the topics above. Fall and Spring semesters. Prerequisite: Knowledge of high school algebra and trigonometry.
Attributes: Natural Science Req (A&S)

PHYS 1610 - Engineering Physics I
Credit(s): 3 Credits
Calculus and vector approaches to study of kinematics, statics and dynamics; work and energy; impulse and momentum; circular motion and gravity; rotational motion and equilibrium; vibrations, waves and sound; heat; fluid mechanics; elasticity.
Prerequisite(s): ((MATH 1510 or MATH 1520)*)
* Concurrent enrollment allowed.
Corequisite(s): PHYS 1620
Attributes: Natural Science Req (A&S)
PHYS 1620 - Engineering Physics I Laboratory
Credit(s): 1 Credit
Laboratory experiments to illustrate and supplement material in PHYS 1610. (Offered every Fall and Spring)
Corequisite(s): PHYS 1610
Attributes: Natural Science Req (A&S)

PHYS 1630 - Engineering Physics II
Credit(s): 3 Credits
Calculus and vector approaches to study of electric charges, forces, fields and potentials; electric current; magnetic forces and fields; electromagnetic waves; light and geometrical optics; mirrors and lenses. (Offered every Fall and Spring)
Prerequisite(s): (PHYS 1610, PHYS 1620, and PHYS 1640)*
Corequisite(s): PHYS 1640
Attributes: Natural Science Req (A&S)

PHYS 1930 - Special Topics
Credit(s): 3 Credits (Repeatable for credit)
Attributes: Natural Science Req (A&S)

PHYS 1980 - Independent Study
Credit(s): 1-3 Credits (Repeatable for credit)
Attributes: Natural Science Req (A&S)

PHYS 2610 - Modern Physics
Credit(s): 3 Credits
Lectures three hours per week. At the level of Beiser’s Concepts of Modern Physics. (Offered every Spring)
Attributes: Natural Science Req (A&S)

PHYS 2620 - Modern Physics Lab
Credit(s): 1 Credit
(Offered every Fall)
Prerequisite(s): PHYS 2610*, (MATH 143* or Math Waiver per Advisor with a minimum score of 1520)
* Concurrent enrollment allowed.
Attributes: Natural Science Req (A&S)

PHYS 2910 - Co-op with Industry
Credit(s): 0 Credits (Repeatable for credit)
A full-time supervised work experience with an agency, firm or organization that employs persons in this degree field. This course is used for the first experiential learning session. Grading system is determined by department offering course. Prerequisite: Sophomore standing. Offered every semester.
Attributes: Natural Science Req (A&S)

PHYS 2930 - Special Topics
Credit(s): 1-4 Credits (Repeatable for credit)
Attributes: Natural Science Req (A&S)

PHYS 3110 - Classical Mechanics
Credit(s): 3 Credits
The elementary theory of the statics, kinematics and dynamics of particles and rigid bodies. At the level of Symon’s Mechanics.
Prerequisite(s): MATH 2530
Attributes: Natural Science Req (A&S)

PHYS 3120 - Advanced Classical Mechanics
Credit(s): 3 Credits
Continuation of PHYS-3110, continuum mechanics and introduction to the analytical methods of Lagrange and Hamilton.
Attributes: Natural Science Req (A&S)

PHYS 3310 - Optics
Credit(s): 3 Credits
Lectures and demonstrations three hours per week. Physical and geometrical optics.
Attributes: Natural Science Req (A&S)

PHYS 3320 - Optics Laboratory
Credit(s): 1 Credit
The fundamental experiments of modern optics are repeated in this course. Three hours per week.
Corequisite(s): PHYS 3310
Attributes: Natural Science Req (A&S)

PHYS 3410 - Thermodynamics and Statistical Mechanics
Credit(s): 3 Credits
At the level of Schroeder’s Thermal Physics.
Prerequisite(s): MATH 3550* and PHYS 1630*
* Concurrent enrollment allowed.
Attributes: Natural Science Req (A&S)

PHYS 3510 - Analog & Digital Electronics
Credit(s): 0 or 4 Credits
Lecture-laboratory six hours per week. Fundamentals of digital circuits with applications to computers. Operational amplifiers. Interfacing of computers with experimental equipment for data collection and control.
Attributes: Natural Science Req (A&S)

PHYS 3610 - Modern Physics II
Credit(s): 3 Credits
Attributes: Natural Science Req (A&S)

PHYS 3860 - Physics Research I
Credit(s): 0 Credits (Repeatable for credit)
First of three course sequence required for B.S. degree in Physics.
Attributes: Natural Science Req (A&S)

PHYS 3910 - Co-op with Industry
Credit(s): 0 Credits (Repeatable for credit)
A full-time supervised work experience with an agency, firm or organization that employs persons in this degree field. This course is used for the second experiential learning session. (Offered every Fall, Spring and Summer)
Prerequisite(s): PHYS 2910
Attributes: Natural Science Req (A&S)
PHYS 3950 - Internship with Industry
Credit(s): 0-3 Credits (Repeatable for credit)
A work experience with an agency, firm or organization that employs persons in this degree field. This experience may be full time or part-time as required by the industry sponsor. This course is used for the first experiential learning session. (Offered every semester)
Restrictions:
Enrollment limited to students with a semester level of Junior or Senior.
Attributes: Natural Science Req (A&S)

PHYS 3930 - Special Topics
Credit(s): 3 Credits (Repeatable for credit)

PHYS 3980 - Independent Study
Credit(s): 1-3 Credits (Repeatable for credit)
Attributes: Natural Science Req (A&S)

PHYS 4010 - Nanoscience and Nanofabrication Frontiers
Credit(s): 0 or 3 Credits
The Nanoscale Science and Nanotechnology applications have become increasingly important for industry and manufacturing. This interdisciplinary physics course is designed to introduce concepts and take a detailed look at how to study, understand and present interdisciplinary science that has significant experimental design components. This course will be devoted to several topics such as Nanoscale Physics, Nanomaterials Engineering, Nanofabrication and Nanolithography.
Prerequisite(s): CHEM 1110 with a grade of C or higher; MATH 2530 with a grade of C or higher; PHYS 1630 with a grade of C or higher
Attributes: Natural Science Req (A&S)

PHYS 4020 - Experimental Physics
Credit(s): 3 Credits
Experimental Physics teaches students basic techniques such as principles of ultra high vacuum, IV curve and resistance measurements, computer automation, microwave circuit design and measurements. We will also measure microwave resonators and quantum bits at 50 mK. All class work will consist of lab work in a studio classroom.
Attributes: Natural Science Req (A&S)

PHYS 4030 - Mathematical Methods in Physics with elements of Classical Mechanics
Credit(s): 3 Credits
The course introduces a variety of powerful mathematical techniques of great utility to physics. Topics covered include differential and integral equations, complex analysis, Green's functions, and variational methods, including Lagrangian and Hamiltonian formalisms. Mathematical methods are illustrated with examples from modern research topics.
Prerequisite(s): PHYS 261 and MATH 370
Attributes: Natural Science Req (A&S)

PHYS 4040 - Numerical Analysis and Computational Physics
Credit(s): 3 Credits
The course introduces numerical techniques and computing strategies used in computational physics and engineering. It will provide practical knowledge of computing on different platforms, ranging from High Performance Computing clusters to embedded systems in modern devices. Topics covered include linear algebra, filters, finite elements, optimization, parallel computing.
Attributes: Natural Science Req (A&S)

PHYS 4110 - Intro to Biophysics
Credit(s): 3 Credits
This course covers the basic concepts in biophysics at the fluid, cellular, macromolecular, and molecular levels, including diffusion processes, self-assembly, cooperative transitions, ion pumping, basic ideas of "molecular machines", and passage of action potentials in neurons.
Prerequisite(s): PHYS 3410
Attributes: Natural Science Req (A&S)

PHYS 4210 - Electricity & Magnetism I
Credit(s): 3 Credits
Lecture three hours per week. At the level of Griffiths, Introduction to Electrodynamics. (Offered every Spring)
Prerequisite(s): MATH 3550
Attributes: Natural Science Req (A&S)

PHYS 4220 - Electricity & Magnetism II
Credit(s): 3 Credits
Lecture three hours per week. Electromagnetic Fields at an advanced level, a continuation of PHYS 4210. (Offered every Fall)
Attributes: Natural Science Req (A&S)

PHYS 4410 - General Relativity
Credit(s): 3 Credits
This course is an introduction to Einstein's Theory of General Relativity. The special theory of relativity is reviewed, tensor analysis is introduced, and the general theory is approached through an examination of curved space-time and geodesic trajectories. Applications including black holes and cosmology are explored.
Prerequisite(s): MATH 3550; PHYS 2610
Attributes: Natural Science Req (A&S)

PHYS 4610 - Quantum Mechanics
Credit(s): 3 Credits
At the level of Griffiths, Introduction to the Quantum Mechanics.
Prerequisite(s): PHYS 2610; PHYS 3110
Attributes: Natural Science Req (A&S)

PHYS 4620 - Application of Quantum Mechanics
Credit(s): 3 Credits
Further development of Quantum Mechanics with applications to statistical mechanics, quantum optics, atomic, nuclear, particle and solid state physics. (Offered every Spring)
Prerequisite(s): PHYS 4610
Attributes: Natural Science Req (A&S)

PHYS 4840 - Senior Inquiry: Thesis
Credit(s): 0 Credits
Attributes: Natural Science Req (A&S)

PHYS 4870 - Physics Research II
Credit(s): 0 Credits (Repeatable for credit)
Second of three course sequence required for B.S. degree in Physics.
Attributes: Natural Science Req (A&S)

PHYS 4880 - Senior Inquiry: Research Project
Credit(s): 3 Credits (Repeatable for credit)
Third of three course sequence required for B.S. degree in Physics (3 Cr), or satisfies senior inquiry requirement for B.A. degree in Physics (0-3 Cr).
Attributes: Natural Science Req (A&S)

PHYS 4890 - Senior Inquiry: Comprehensive Examination
Credit(s): 0 Credits
Attributes: Natural Science Req (A&S)
PHYS 4910 - Co-Op with Industry
Credit(s): 0 Credits (Repeatable for credit)
A full-time supervised work experience with an agency, firm or organization that employs persons in this degree field. This course is used for the third experiential learning session. (Offered every Fall, Spring and Summer)
Prerequisite(s): PHYS 3910
Attributes: Natural Science Req (A&S)

PHYS 4915 - Internship with Industry
Credit(s): 0-3 Credits (Repeatable for credit)
A work experience with an agency, firm or organization that employs persons in this degree field. This experience may be full time or part-time as required by the industry sponsor. (Offered every Fall, Spring and Summer)
Prerequisite(s): PHYS 3915
Attributes: Natural Science Req (A&S)

PHYS 4930 - Special Topics
Credit(s): 3 Credits (Repeatable for credit)
Attributes: Natural Science Req (A&S)

PHYS 4980 - Advanced Independent Study
Credit(s): 1-6 Credits (Repeatable for credit)
Prior permission of sponsoring professor and chairperson required.
Attributes: Natural Science Req (A&S)

PHYS 5010 - Nanoscience and Nanofabrication Frontiers
Credit(s): 0 or 3 Credits
Nanoscience and Nanotechnology applications have become increasingly important for industry and manufacturing. This course is designed to introduce concepts and take a detailed look at how to study, understand and present interdisciplinary science. The course will be devoted to several topics in Nanoscale physics, Nanochemistry, Nanomaterials, Nanofabrication and Nanolithography.

PHYS 5020 - Experimental Physics
Credit(s): 3 Credits
Experimental Physics teaches students basic techniques such as principles of ultra high vacuum, IV curve and resistance measurements, computer automation using LabVIEW, computer drafting of micro scale circuitry using L-Edit, and microwave simulations using Sonnet. All class work will consist of lab work in a studio classroom. Offered periodically in even years.

PHYS 5030 - Mathematical Methods in Physics
Credit(s): 3 Credits
This course introduces a variety of powerful mathematical techniques of great utility to physics. Topics covered include differential and integral equations, complex analysis, Green's functions, and variational methods, including Lagrangian and Hamiltonian formalism of classical mechanics. Mathematical methods are illustrated with examples from electrodynamics, statistical, quantum, and classical mechanics.

PHYS 5060 - Numerical Analysis and Computational Physics
Credit(s): 3 Credits
The course introduces numerical techniques and computing strategies used in computational physics and engineering. It will provide practical knowledge of computing on different platforms, ranging from High Performance Computing clusters to embedded systems in modern devices. Topics covered include linear algebra, filters, finite elements, optimization, parallel computing.
Prerequisite(s): (PHYS 2610, PHYS 3510, CSCI 1060, or CSCI 1300)

PHYS 5310 - Optics for Educators
Credit(s): 3 Credits
This course will provide an upper level introduction to the concepts and techniques of modern optics, including: Review of ray optics and optical properties of lenses; Wave properties of light; Wave interference (including beats); Interference from two discrete sources of light; Interference from N discrete sources of light; Diffraction of light passing through apertures and past obstacles (plugs); Quantum nature of light (including photon counting); Laser physics. (Offered every Spring)

PHYS 5320 - Optics Lab for Educators
Credit(s): 1 Credit
This course will provide an upper level introduction to the concepts and techniques of modern optics, including: Review of ray optics and optical properties of lenses; Wave properties of light; Wave interference; Interference from two discrete sources of light; Interference from N discrete sources of light; Diffraction of light passing through apertures and past obstacles; Quantum nature of light (including photon counting); Laser physics, including principles of Raman Spectroscopy and Confocal Raman Imaging. (Offered every Spring)

PHYS 5510 - Electronics for Educators
Credit(s): 4 Credits
This course will provide an upper level introduction to the concepts and techniques of modern electronics. It will give fundamentals of analog and digital circuits design, characterization, and integration with computing system in modern classroom. The covered material includes filters, amplifiers, digital logic, analog and digital signal processing, micro-controllers. A special emphasis will be made on hands-on experience with modern circuits design for high-impact demonstrations. (Offered every Fall)

PHYS 5610 - Modern Physics for Educators
Credit(s): 3 Credits
This course will provide an upper level introduction to topics in Modern Physics including Atomic Physics, Statistical Physics, Molecular Physics, Solid State Physics, Nuclear Physics, Elementary particle Physics, Astrophysics, and Cosmology.

PHYS 5910 - Independent Study
Credit(s): 1 or 3 Credits (Repeatable for credit)

PHYS 5980 - Independent Study
Credit(s): 3 Credits (Repeatable for credit)

PHYS 5930 - Special Topics
Credit(s): 3 Credits (Repeatable for credit)