

# PHYSICS (PHYS)

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**PHYS-COMP Senior Comprehensive Exam**  
(NULL credits) (Both Fall & Spring Semesters)  
Senior Comprehensive Exam (cr)

**PHYS-1100 Concepts in Physics**  
(4 credits) (Both Fall & Spring Semesters)  
Concepts in Physics (4) (B) This one-semester, algebra-based course covers a wide range of physics topics including Newtonian mechanics, thermodynamics, electricity and magnetism, optics, and modern physics. The conceptual and historical aspects of these topics are also discussed. There are three lecture sessions and one lab session per week. (NW, SM)  
**General Education Categories:** Scientific Method, Understanding the Natural World

**PHYS-1200 Acoustics**  
(4 credits) (Fall Semester)  
Acoustics (4) (F) Acoustics is the study of the production, propagation, and perception of sound in its various forms (speech, music, noise, etc.). This course covers the fundamentals of acoustics and their application to music and other areas such as environmental sound and sound reproduction systems. It is recommended to music majors and others interested in sound. No formal background in music or college-level mathematics or science is required. There are three class meetings and a lab period each week. Offered fall semester of odd years. (NW, SM)  
**General Education Categories:** Scientific Method, Understanding the Natural World

**PHYS-1300 Our Strange Universe**  
(3 credits) (Fall Semester)  
Our Strange Universe (3) (F) Ideas such as time travel, black holes, and multiple universes may sound rather fantastic, but modern physics tells us that these may in fact be a reality in our world. This course aims to introduce non-science majors to the theories of special relativity, general relativity, and quantum mechanics that form the foundations of modern physics. Particular attention will be paid to the many surprising and counter-intuitive consequences of these theories. Offered fall semester of even years. (NW)  
**General Education Categories:** Understanding the Natural World

**PHYS-2000 College Physics I**  
(3 credits) (Fall Semester)  
College Physics I (4) (F) This is an algebra-based physics course designed for biology, biochemistry, and other majors that do not require a calculus-based class. Mechanics, including Newton's laws of motion, work and energy, collisions, rotational motion, gravitation, fluid mechanics, and the laws of thermodynamics will be studied. Three lecture/discussions and one two-hour lab a week. Students must also take and successfully complete PHYS-2001 to fulfill the general education requirements. Co-requisite: PHYS-2001. (NW, SM).  
**General Education Categories:** Scientific Method, Understanding the Natural World

**PHYS-2001 College Physics I Lab**  
(1 credit) (Fall Semester)  
College Physics I Lab (0) (F) This is a weekly, two-hour companion lab for PHYS-2000. Experiments are coordinated with lecture topics. Students must also take and successfully complete PHYS-2000 to fulfill the general education requirements. (NW, WC)  
**Corequisite(s):** PHYS-2000.  
**General Education Categories:** Written Communication

**PHYS-2010 College Physics II**  
(3 credits) (Spring Semester)  
College Physics II (4) (S) This is an algebra-based physics course designed for biology, biochemistry, and other majors that do not require a calculus-based class. Electrostatics, DC circuits, magnetic fields and forces, electromagnetism, waves, sound, and geometrical and physical optics will be studied. Three lecture/discussions and one two-hour lab a week.  
**Prerequisite(s):** PHYS-2000 **Corequisite:** PHYS-2011.

**PHYS-2011 College Physics Lab II**  
(1 credit) (Spring Semester)  
College Physics II Lab (0) (S) This is a weekly, two-hour companion lab for PHYS-2010. Experiments are coordinated with lecture topics.  
**Corequisite(s):** PHYS-2010.

**PHYS-2100 Classical Physics I**  
(3 credits) (Fall Semester)  
Classical Physics I (3) (F) This is a calculus-based course designed for students in the sciences and engineering. Mechanics, including Newton's laws of motion, work and energy, collisions, rotational motion, gravitation, fluid mechanics, and the laws of thermodynamics will be discussed. Three lecture/discussions and one two-hour lab a week. Students must also take and successfully complete PHYS-2101 to fulfill the general education requirements. Co-requisites: MATH-1300 and PHYS-2101. (NW, SM).  
**General Education Categories:** Scientific Method, Understanding the Natural World

**PHYS-2101 Classical Physics I Lab**  
(1 credit) (Fall Semester)  
Classical Physics I Lab (1) (F) This is a weekly, two-hour companion lab for PHYS-2100. Experiments are coordinated with lecture topics. Students must also take and successfully complete PHYS-2100 to fulfill the general education requirements. Co-requisite: PHYS-2100. (WC).  
**General Education Categories:** Written Communication

**PHYS-2110 Classical Physics II**  
(3 credits) (Spring Semester)  
Classical Physics II (3) (S) This is a calculus-based course designed for students in the sciences and engineering. Electrostatics, DC circuits, magnetic fields and forces, electromagnetism, waves, sound, and geometrical and physical optics will be discussed. Three lecture/discussions and one two-hour lab a week. Students must also take and successfully complete PHYS-2111 to fulfill the general education requirements. Co-requisite: PHYS-2111. (NW, SM).  
**Prerequisite(s):** PHYS-2100.  
**General Education Categories:** Scientific Method, Understanding the Natural World

**PHYS-2111 Classical Physics II Lab**  
(1 credit) (Spring Semester)  
Classical Physics II Lab (1) (S) This is a weekly, two-hour companion lab for PHYS-2110. Experiments are coordinated with lecture topics. Students must also take and successfully complete PHYS-2110 to fulfill the general education requirements. Co-requisite: PHYS-2110.

**PHYS-3200 Relativity & Atomic Physics****(3 credits) (Fall Semester)**

Relativity and Atomic Physics (3) (F) Einstein's postulates of Special Relativity, including relativistic mechanics and relativistic electromagnetism, will be treated analytically. Discussion of general relativistic theories will be presented. Modern physics concepts including wave/particle duality, atomic theory, introductory quantum mechanics, and the hydrogen atom will be discussed.

**Prerequisite(s):** PHYS-2110.**PHYS-3201 Modern Physics Lab****(1 credit) (Fall Semester)**

Modern Physics Laboratory (1) (F) A series of lectures on the treatment of experimental uncertainties will be alternated with experiments illustrating many important concepts in modern physics, such as measuring  $e/m$  of the electron, measuring the speed of light, the photoelectric effect, the Millikan oil drop experiment, and x-ray spectroscopy.

**Corequisite(s):** PHYS-3200.**PHYS-3210 Nuclear & Elementary Particle Physics****(2 credits) (Spring Semester)**

Nuclear and Elementary Particle Physics (2) (S) Radiation, nuclear decay processes, fission, fusion, particle accelerators and detectors will be treated. Elementary particle theory, including quark and gauge theories will be discussed.

**Prerequisite(s):** PHYS-3200.**PHYS-3211 Modern Physics Lab II****(1 credit) (Spring Semester)**

Modern Physics Laboratory II (1) (S) Lectures on the treatment of data will continue and alternate with experiments in radioactivity, gamma ray spectroscopy, nuclear physics, and condensed matter physics.

**Corequisite(s):** PHYS-3210.**PHYS-3500 Electronics****(4 credits) (Spring Semester)**

Electronics (4) (S) This is an experimentally-oriented course that explores the theoretical and applied aspects of electronic circuit components and circuits, digital electronics, integrated circuits, and electrical machines with some treatment of microcomputer interfacing techniques needed in laboratory data acquisition and management.

**Prerequisite(s):** PHYS-2110.**PHYS-4100 Mechanics I****(3 credits) (Fall Semester)**

Mechanics I (3) (F) Newtonian mechanics will be studied, emphasizing physical concepts and mathematical techniques essential for most other advanced physics courses. Topics covered include motion of particles in one, two, and three dimensions, vector algebra, mathematical methods, and motion of systems of particles. Offered fall semester of even years.

**Prerequisite(s):** PHYS-2110 and MATH-3100.**PHYS-4110 Mechanics II****(3 credits) (Spring Semester)**

Mechanics II (3) (S) A continuation of PHYS-4100, treating motion of rigid bodies, gravitation, moving coordinate systems, the vibrating string problem, fluid mechanics, Lagrange's and Hamilton's methods, and tensor algebra. Offered spring semester of odd years.

**Prerequisite(s):** PHYS-4100.**PHYS-4200 Mathematical Methods for Physics****(3 credits) (Fall Semester)**

Mathematical Methods for Physics (3) (F) Basic mathematical topics and techniques used in the study of physics are examined. This includes topics such as infinite series, complex analysis, matrices, tensor analysis, the calculus of variations, recursion relations, Legendre polynomials, and Bessel functions. Offered fall semester of even years.

**Prerequisite(s):** PHYS-2110 and MATH-1350.**PHYS-4300 Optics****(3 credits) (Spring Semester)**

Optics (3) (S) This course continues the study of the principles of geometrical and physical optics. Topics of discussion include the laws of reflection and refraction, paraxial theory, polarization, interference, diffraction, fiber optics, and lasers and holography. Offered spring semester of odd years.

**Prerequisite(s):** PHYS-2110 and MATH-1350.**PHYS-4301 Optics Laboratory****(1 credit) (Spring Semester)**

Optics Laboratory (1) (S) Experiments exploring the phenomena of geometrical optics, polarization, diffraction, and interference will be performed to supplement the material covered in PHYS-4300. The experiments will use equipment such as the laser, spectroscope, charge coupled device (CCD), photodiode array, high-resolution spectrometer, fiber optics, and computer modeling. Offered spring semester of odd years.

**Corequisite(s):** PHYS-4300.**PHYS-4400 Thermodynamics****(3 credits) (Fall Semester)**

Thermodynamics (3) (F) This course is an introduction to thermodynamics and its applications. Topics include temperature, heat, work, the three fundamental laws of thermodynamics, and an introduction to statistical mechanics. Applications pertinent to both physics and engineering majors will be covered, including gas laws, heat engines, and chemical equilibria. Offered fall semester of odd years.

**Prerequisite(s):** PHYS-2110, MATH-2300, and CHEM-1210.**PHYS-4457 Methods of Teaching Secondary Physics****(2 credits) (Discretion of Department)**

Methods for Teaching Secondary Physics (3) (D) This course acquaints the student with special techniques, current technologies in teaching strategies, and devices for teaching the natural sciences and evaluating student progress in the classroom and laboratory; the planning and presentation of laboratory work and material; the use and maintenance of equipment, and the selection and purchase of laboratory supplies. Some consideration will be given to the journals, handbooks, and other technical literature useful in teaching science. Lecture: two hours.

**Prerequisite(s):** EDUC-3357 and EDUC-3358.**PHYS-4600 Electricity & Magnetism I****(3 credits) (Fall Semester)**

Electricity and Magnetism I (3) (F) The physical and mathematical concepts underlying our understanding of electrostatic fields are developed. Topics covered include a review of vector calculus, the electrostatic field in a vacuum and in dielectric media, and energy and force relationships for the electrostatic field. An extensive investigation of methods of solution of the Laplace and Poisson equations is also made. Offered fall semester of odd years.

**Prerequisite(s):** PHYS-2110 and MATH-3100.

**PHYS-4610 Electricity & Magnetism II****(3 credits) (Spring Semester)**

Electricity and Magnetism II (3) (S) As a continuation of PHYS-4600, this course develops the mathematical and physical concepts of magnetostatic fields, which, when joined with those of electrostatics, lead to Maxwell's equations. This course also serves as an introduction to theories of wave propagation in free space and conducting media, and radiation (electrodynamics). Offered spring semester of even years.

**Prerequisite(s):** PHYS-4600.**PHYS-4620 Plasma Physics****(3 credits) (Spring Semester)**

Plasma Physics (3) (S) This course is an introduction to the physics of the plasma state, including discussions of the magnetohydrodynamic (MHD) equations, MHD waves and stability, plasma confinement and fusion, cold plasma theory, and the kinetic theory of plasmas. Offered spring semester of even years.

**Corequisite(s):** PHYS-4610.**PHYS-4700 Condensed Matter Physics****(3 credits) (Spring Semester)**

Condensed Matter Physics (3) (S) Crystal structure, the reciprocal lattice, thermal and electrical properties of metals and insulators, optical properties, semiconductor theory, and superconductivity will be discussed. Offered spring semester of even years.

**Prerequisite(s):** PHYS-3200.**PHYS-4800 Quantum Mechanics****(3 credits) (Fall Semester)**

Quantum Mechanics (3) (F) This course is a general introduction to quantum mechanics. Topics discussed include wave-particle duality, Schrödinger's equation, the square well, potential barriers, the harmonic oscillator, parity, angular momentum and spin, hydrogenic atoms, and approximation techniques. Co-requisite: PHYS-4100.

**PHYS-4900 Physics Colloquium****(NULL credits) (Both Fall & Spring Semesters)**

Physics Colloquium (cr) (B) Monthly meetings at which recent developments in physics will be presented by the staff, students, and guest lecturers. Required of all junior and senior physics and astronomy majors.

**PHYS-4901 Physics Colloquium****(NULL credits) (Both Fall & Spring Semesters)**

Physics Colloquium (cr) (B) Monthly meetings at which recent developments in physics will be presented by the staff, students, and guest lecturers. Required of all junior and senior physics and astronomy majors.

**PHYS-4902 Physics Colloquium****(NULL credits) (Both Fall & Spring Semesters)**

Physics Colloquium (cr) (B) Monthly meetings at which recent developments in physics will be presented by the staff, students, and guest lecturers. Required of all junior and senior physics and astronomy majors.

**PHYS-4903 Physics Colloquium****(NULL credits) (Both Fall & Spring Semesters)**

Physics Colloquium (cr) (B) Monthly meetings at which recent developments in physics will be presented by the staff, students, and guest lecturers. Required of all junior and senior physics and astronomy majors.

**PHYS-4910 Physics & Astronomy Research****(1 credit) (Both Fall & Spring Semesters)**

Physics & Astronomy Research (1) (B) Students will engage in research under the guidance of a faculty member. Focus will be on research methods and presentation of results. The class will culminate in a public talk by the student on his/her research results. (OC, VC)

**General Education Categories:** Oral Communication, Visual Communication