PHYSICS (PHYS)

# Course numbers with the # symbol included (e.g. #400) have not been taught in the last 3 years.

PHYS 805 - Experimental Physics
Credits: 4
Experiments in nuclear, solid-state, and surface physics. Includes discussion of laboratory techniques, data analysis, and data presentation. Special projects assigned to individual students.
Repeat Rule: May be repeated up to 1 time.
Grade Mode: Letter Grading

PHYS 806 - Introduction to Physics Research and Teaching
Credits: 1
This course introduces new graduate students to both research and teaching. The teaching portion focuses on facilitating group work, problem solving, and deeper student thinking. The research portion focuses on research currently conducted at UNH, library resources, responsible conduct in research, how research differs from coursework, and how research results are presented in the research community.
Grade Mode: Graduate Credit/Fail grading

PHYS 810 - Astrophysics I
Credits: 4
A comprehensive review of modern astrophysics. Topics covered include the celestial sphere, celestial mechanics, the tools of the modern astronomer (including different types of telescopes for studying the electromagnetic radiation from space), stellar spectra, stellar atmospheres, stellar interiors, the formation of stars, stellar evolution, and the stellar graveyard (white dwarfs, neutron stars, and black holes).
Equivalent(s): EOS 810
Grade Mode: Letter Grading

PHYS #811 - Astrophysics II
Credits: 4
A continuation of the comprehensive review of modern astrophysics. Topics covered include the degenerate stellar remnants (white dwarfs, neutron stars, black holes), the interstellar medium, the Milky Way Galaxy, the nature of galaxies, the evolution of galaxies, the structure of the Universe, active galaxies, cosmology, and the early Universe.
Prerequisite(s): PHYS 810 with a minimum grade of B-.
Grade Mode: Letter Grading

PHYS 812 - Introduction to Space Plasma Physics
Credits: 4
Introduction to the subject of space plasma physics including solar physics, heliospheric physics, magnetospheric physics, and ionospheric physics. The course provides an overview of the basic phenomena and processes (e.g. particle acceleration and transport, shock formation, magnetic structures and reconnection, wave propagation, wave-particle interactions, instabilities), theoretical techniques (e.g. single-particle orbits, kinetic and fluid descriptions), and experimental techniques. (Alternate years only.)
Equivalent(s): EOS 812
Grade Mode: Letter Grading

PHYS 818 - Introduction to Solid-State Physics
Credits: 4
Crystal structure, diffraction, lattice vibrations, electronic and optical properties of metals and semiconductors; selected topics in modern condensed matter physics. Coursework in statistical mechanics and quantum mechanics required. (Normally offered every other year.)
Grade Mode: Letter Grading

PHYS 820 - Nuclear Physics
Credits: 4
Nuclear phenomenology, reactions, models, radiation, interaction of radiation with matter; accelerators; properties and interactions of elementary particles; symmetries and symmetry breaking standard model. Introductory coursework in quantum mechanics, electricity and magnetism required.
Grade Mode: Letter Grading

PHYS 864 - General Relativity and Cosmology
Credits: 4
Review of special relativity, and the motivation for considering gravity in terms of curvature of space time. Introduction to Riemannian geometry, general relativity and Einstein's equations. Application of general relativity in the study of black holes, gravitational waves, cosmology, as well as recent results on inflation and quantum gravity. (Alternate years only.)
Grade Mode: Letter Grading

PHYS 895 - Independent Study
Credits: 1-8
Individual project under direction of a faculty adviser.
Grade Mode: Letter Grading

PHYS 899 - Master's Thesis
Credits: 1-6
Master's Thesis.
Repeat Rule: May be repeated for a maximum of 6 credits.
Grade Mode: Graduate Credit/Fail grading

PHYS 931 - Mathematical Physics
Credits: 3
Complex variables, differential equations, asymptotic methods, integral transforms, special functions, linear vector spaces and matrices, Green's functions, and additional topics selected from integral equations, variational methods, numerical methods, tensor analysis, and group theory.
Equivalent(s): MATH 931
Grade Mode: Letter Grading

PHYS 935 - Statistical Physics
Credits: 3
Review of thermodynamics and kinetic theory, followed by an introduction to classical and quantum statistical mechanics. Microcanonical, canonical, and grand canonical ensembles; ideal Fermi and Bose gases and applications of statistical mechanics to selected physical problems.
Prerequisite(s): PHYS 931 with a minimum grade of B- and PHYS 939 with a minimum grade of B- and PHYS 943 with a minimum grade of B-.
Grade Mode: Letter Grading

PHYS 939 - Classical Mechanics
Credits: 3
Newtonian, Lagrangian, and Hamiltonian formulation of the classical mechanics of particles and rigid bodies. Topics that serve as background for the study of modern physical theories are emphasized.
Grade Mode: Letter Grading
PHYS 941 - Electromagnetic Theory I
Credits: 3
The formulation and detailed application of electromagnetic theory to physical problems. The material covered is at the level of the text by J.D. Jackson, "Classical Electrodynamics".
Grade Mode: Letter Grading

PHYS 942 - Electromagnetic Theory II
Credits: 3
The formulation and detailed application of electromagnetic theory to physical problems. The material covered is at the level of the text by J.D. Jackson, "Classical Electrodynamics".
Grade Mode: Letter Grading

PHYS 943 - Quantum Mechanics I
Credits: 3
Introduces non-relativistic quantum theory, covering wave mechanics, Dirac notation, angular momentum, the use of perturbation theory to calculate atomic energy levels, the interaction of atoms with radiation, and various approaches to calculating the differential scattering cross-section.
Grade Mode: Letter Grading

PHYS 944 - Quantum Mechanics II
Credits: 3
See description for PHYS 943.
Grade Mode: Letter Grading

PHYS 951 - Plasma Physics
Credits: 3
Kinetic theory of plasmas; plasma waves, instabilities, turbulence, diffusion, adiabatic motion of charged particles, nonlinear plasma phenomena. (Normally offered every other year.)
Prerequisite(s): PHYS 935 with a minimum grade of B- and PHYS 941 with a minimum grade of B-.
Grade Mode: Letter Grading

PHYS 952 - Magnetohydrodynamics of the Heliosphere
Credits: 3
Introduction to solar physics, with emphasis on gas dynamics and magnetic fields. Interior structure, the theory of convection, wave motions in the presence of magnetism and gravity, coronal heating theories, steady and nonsteady flows, dynamo theory, and the theory of solar flares and other transient phenomena. Salient observational data are reviewed. ( Normally offered every other year.)
Prerequisite(s): PHYS 941 with a minimum grade of B- and PHYS 942 with a minimum grade of B-.
Grade Mode: Letter Grading

PHYS 953 - Magnetohydrodynamics of the Heliosphere
Credits: 3
Introduction to solar physics, with emphasis on gas dynamics and magnetic fields. Interior structure, the theory of convection, wave motions in the presence of magnetism and gravity, coronal heating theories, steady and nonsteady flows, dynamo theory, and the theory of solar flares and other transient phenomena. Salient observational data are reviewed. ( Normally offered every other year.)
Prerequisite(s): PHYS 941 with a minimum grade of B- and PHYS 942 with a minimum grade of B-.
Grade Mode: Letter Grading

PHYS 954 - Heliospheric Physics
Credits: 3
The solar wind and its effects on cosmic rays. The basic equations of the solar wind: mass, momentum, angular momentum, and energy balance. Transport processes. Waves, shocks, and instabilities in the solar wind. The basic equations of energetic particle transport. Solar modulation of solar and galactic cosmic rays. Interaction of energetic particles with shock waves. Salient data are reviewed. (Normally offered every other year.) Also offered as EOS 954.
Equivalent(s): EOS 954
Grade Mode: Letter Grading

PHYS 955 - Advanced Solid-State Physics
Credits: 3
Theory of crystalline metals, semiconductors, and insulators. Selected topics from the following: surfaces, films, quantum dots, clusters, solid-state devices. ( Normally offered every other year.)
Prerequisite(s): PHYS 935 with a minimum grade of B- and PHYS 941 with a minimum grade of B- and PHYS 943 with a minimum grade of B-.
Grade Mode: Letter Grading

PHYS 956 - Advanced Solid-State Physics
Credits: 3
The formulation and detailed application of electromagnetic theory to physical problems. The material covered is at the level of the text by J.D. Jackson, "Classical Electrodynamics".
Grade Mode: Letter Grading

PHYS 957 - Advanced Quantum Mechanics I
Credits: 3
Relativistic wave equations, propagator theory and Feynman diagrams, quantum theory of radiation, second quantization, introduction to quantum field theory and related topics. ( Normally offered every other year.)
Prerequisite(s): PHYS 939 with a minimum grade of B- and PHYS 944 with a minimum grade of B-.
Grade Mode: Letter Grading

PHYS 958 - Advanced Quantum Mechanics II
Credits: 3
Relativistic wave equations, propagator theory and Feynman diagrams, quantum theory of Radiation, second quantization, introduction to quantum field theory and related topics.
Grade Mode: Letter Grading

PHYS 959 - Magnetospheres
Credits: 3
Introduction to plasma physics, with emphasis on gas dynamics and magnetohydrodynamics. The first part of the course covers the magnetic field of the Earth. Both MHD and kinetic descriptions of internal and boundary processes of magnetospheres as well as treatment of the interaction with collisional ionospheres. Flow of mass, momentum, and energy, through such systems. (Normally offered every other year.)
Prerequisite(s): PHYS 915 with a minimum grade of B- and PHYS 952 with a minimum grade of B-.
Equivalent(s): EOS 987
Grade Mode: Letter Grading

PHYS 960 - Advanced Solid-State Physics
Credits: 3
The formulation and detailed application of electromagnetic theory to physical problems. The material covered is at the level of the text by J.D. Jackson, "Classical Electrodynamics".
Grade Mode: Letter Grading

PHYS 961 - Advanced Quantum Mechanics II
Credits: 3
Relativistic wave equations, propagator theory and Feynman diagrams, quantum theory of radiation, second quantization, introduction to quantum field theory and related topics. ( Normally offered every other year.)
Prerequisite(s): PHYS 939 with a minimum grade of B- and PHYS 944 with a minimum grade of B-.
Grade Mode: Letter Grading

PHYS 962 - Advanced Quantum Mechanics II
Credits: 3
Relativistic wave equations, propagator theory and Feynman diagrams, quantum theory of Radiation, second quantization, introduction to quantum field theory and related topics. ( Normally offered every other year.)
Prerequisite(s): PHYS 939 with a minimum grade of B- and PHYS 944 with a minimum grade of B-.
Grade Mode: Letter Grading

PHYS 987 - Magnetospheres
Credits: 3
Introduction to magnetospheres, with emphasis on gas dynamics and magnetohydrodynamics. The first part of the course covers the magnetic field of the Earth. Both MHD and kinetic descriptions of internal and boundary processes of magnetospheres as well as treatment of the interaction with collisional ionospheres. Flow of mass, momentum, and energy, through such systems. (Normally offered every other year.)
Prerequisite(s): PHYS 915 with a minimum grade of B- and PHYS 952 with a minimum grade of B-.
Equivalent(s): EOS 987
Grade Mode: Letter Grading

PHYS 988 - High Energy Astrophysics
Credits: 3
One-semester course on the physical principles underpinning the field of high energy astrophysics. The first part of the course covers the underlying physical concepts, including radiation processes, particle acceleration processes, and accretion physics. The second part of the course includes more detailed discussion of the various astrophysical sources that can generate high energy radiations, including pulsars, X-ray binaries, active galactic nuclei, and gamma-ray bursts. An overview of important aspects of experimental methods is also provided.
Prerequisite(s): PHYS 810 with a minimum grade of B-.
Grade Mode: Letter Grading

PHYS 995 - Special Topics
Credits: 1-3
Any special fields of study not covered by the above courses may be included. Topic choices in previous years: astrophysics; elementary particles; lasers/masers; many-body theory; general relativity and cosmology; group theory; atomic physics; quantum theory of light; nonlinear equations, and chaos. May be repeated barring duplication of subject. (Not offered every year.)
Repeat Rule: May be repeated up to unlimited times.
Grade Mode: Letter Grading
PHYS 999 - Doctoral Research
Credits: 0
Doctoral Research.
Grade Mode: Graduate Credit/Fail grading
Special Fee: Yes