

# Physics (PHYS)

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## Courses

### **PHYS 5503 Advanced Modern Physics: 3 semester hours.**

Study of the elementary principles of quantum mechanics and an introduction to atomic, solid state and nuclear physics. Quantum mechanics will be used as much as possible. PREREQ: MATH 3360 and PHYS 3301.

### **PHYS 5504 Advanced Modern Physics: 3 semester hours.**

Study of the elementary principles of quantum mechanics and an introduction to atomic, solid state and nuclear physics. Quantum mechanics will be used as much as possible. PREREQ: PHYS 5503.

### **PHYS 5505 Advanced Laboratory: 2 semester hours.**

Experiments in radiation detection and measurement, nuclear spectroscopy including x-ray and gamma spectroscopies, neutron activation and ion beam methods. Available to Geology, Engineering, Health Physics, and Physics majors. PREREQ: Permission of instructor.

### **PHYS 5510 Science in American Society: 2 semester hours.**

Observational basis of science; technology's historical influences on scientific developments; perceptions of science in contemporary America; tools/strategies for teaching science. Equivalent to GEOL 5510. PREREQ: Permission of instructor.

### **PHYS 5514 Electronic Instrumentation and Measurement: 3 semester hours.**

Lecture course with laboratory requirements. Topics include: DC and AC electrical circuits, Analog pulses, Bipolar Transistors, Field Effect Transistors, Operational amplifiers. PREREQ: PHYS 2212, PHYS 2214, and MATH 3360.

### **PHYS 5515 Statistical Physics: 3 semester hours.**

Topics covered may include kinetic theory, elementary statistical mechanics, random motion and the theory of noise. Choice of topics will depend upon the interest of the students and instructor. PREREQ: PHYS 2212 and MATH 3360.

### **PHYS 5516 Radiation Detection and Measurement: 3 semester hours.**

Lecture/laboratory course emphasizing practical measurement techniques in nuclear physics. PREREQ: CHEM 1111, CHEM 1111L, CHEM 1112, CHEM 1112L, and either PHYS 1111 and PHYS 1113, or PHYS 2211 and PHYS 2213.

### **PHYS 5516L Radiation Detect/Measure Lab: 0 semester hours.**

### **PHYS 5521 Electricity and Magnetism I: 3 semester hours.**

Intermediate course in fundamental principles of electrical and magnetic theory. Free use will be made of vector analysis and differential equations. PREREQ: PHYS 2212 and MATH 3360.

### **PHYS 5522 Electricity and Magnetism: 3 semester hours.**

Intermediate course in fundamental principles of electrical and magnetic theory. Free use will be made of vector analysis and differential equations. PREREQ: PHYS 5521.

### **PHYS 5525 Nuclear and Particle Physics I: 3 semester hours.**

A course in Nuclear and Particle Physics with emphasis on structural models, radioactivity, nuclear reactions, particle interactions, fission and fusion, the standard model of particle physics, symmetries and conservation laws. PREREQ: Knowledge of elementary quantum mechanics and differential equations or permission of instructor.

### **PHYS 5526 Nuclear and Particle Physics II: 3 semester hours.**

A course in Nuclear and Particle Physics with emphasis on structural models, radioactivity, nuclear reactions, particle interactions, fission and fusion, the standard model of particle physics, symmetries and conservation laws.

### **PHYS 5542 Solid State Physics: 3 semester hours.**

Introduction to the field of solid state physics emphasizing the fundamental concepts. Topics usually covered are crystal structure, X-ray diffraction, crystal binding energies, free electron theory of solids, energy bands. PREREQ: PHYS 3301, PHYS 5583, and MATH 3360 or permission of instructor.

### **PHYS 5552 Intermediate Optics: 3 semester hours.**

Wave theory, e/m waves, production of light, measurement of light, reflection, refraction, interference, diffraction, polarization, optical systems, matrix methods, Jones vectors, Fourier optics, propagation of e/m waves in materials, atmospheric optics. COREQ: MATH 3360. PREREQ: PHYS 2212.

### **PHYS 5553 Topics in Astrophysics: 2 semester hours.**

Application of physics to astronomy or cosmology. May include lab exercise. PREREQ: Permission of instructor.

### **PHYS 5561 Introduction to Mathematical Physics I: 3 semester hours.**

Introduction to the mathematics most commonly used in physics with applications to, and practice in, solving physical problems; includes vector analysis, ordinary and partial differential equations. PREREQ: PHYS 2212 and MATH 3360.

### **PHYS 5562 Introduction to Mathematical Physics: 3 semester hours.**

Introduction to the mathematics most commonly used in physics with applications to, and practice in, solving physical problems; includes vector analysis, ordinary and partial differential equations. PREREQ: PHYS 5561.

### **PHYS 5583 Theoretical Mechanics: 4 semester hours.**

Detailed study of the motion of particles, satellites, rigid bodies and oscillating systems. Develop and apply Lagrangian and Hamiltonian methods. PREREQ: PHYS 2212 and MATH 3360.

### **PHYS 5592 Colloquium in Physics: 1 semester hour.**

Faculty and student lectures in current research topics in physics. Open to upper division and graduate students in physics. May be repeated to a maximum of 4 credits.

### **PHYS 5598P Prof Development Workshop: 1-3 semester hours.**

### **PHYS 5599 Experimental Course: 1-6 semester hours.**

The content of this course is not described in the catalog. Title and number of credits are announced in the Class Schedule. Experimental courses may be offered no more than three times with the same title and content. May be repeated.

### **PHYS 6602 Theoretical Methods of Physics: 3 semester hours.**

Calculus of variations, Lagrangian and Hamiltonian formalisms of classical mechanics, some classical scattering theory, methods of solving PDEs, Green's functions, functions of complex variables, vector and tensor analysis, matrix, group and operator theory, and numerical methods integrated throughout each topic.

### **PHYS 6603 Particle Physics: 3 semester hours.**

Basic constituents of the standard model, experimental methods, particle interactions: weak, gravitational, strong and electromagnetic, conservation laws, hadron structure and interactions, unification of interactions, physics beyond the standard model. PREREQ: PHYS 6624 or permission of instructor.

### **PHYS 6609 Advanced Nuclear Physics: 3 semester hours.**

Nucleon-nucleon interaction, bulk nuclear structure, microscopic models of nuclear structure, collective models of nuclear structure, nuclear decays and reactions, electromagnetic interactions, weak interactions, strong interactions, nucleon structure, nuclear applications, current topics in nuclear physics. PREREQ: PHYS 6624 or permission of instructor.

**PHYS 6611 Electricity and Magnetism: 3 semester hours.**

Maxwell's equations and methods of solution, plane wave propagation and dispersion, wave guides, antennas and other simple radiating systems, relativistic kinematics and dynamics, classical interaction of charged particles with matter, classical radiation production mechanisms.

**PHYS 6612 Advanced Electricity and Magnetism: 3 semester hours.**

Advanced topics in application of Maxwell's equations to wave guides, antennas and other simple radiating systems. Particular emphasis upon the relativistic interaction of charged particles with matter, energy loss, and classical radiation production and absorption mechanisms. PREREQ: PHYS 6611 or permission of instructor.

**PHYS 6615 Activation Analysis: 3 semester hours.**

Theory and use of neutron activation methods for quantitative chemical analysis of natural and synthetic materials. Applications in geologic systems will be emphasized. PREREQ: Permission of instructor.

**PHYS 6621 Classical Mechanics: 3 semester hours.**

Lagrange equations, small vibrations; Hamilton's canonical equations; Hamilton's principal, least action; contact transformation; Hamilton-Jacobi equation, perturbation theory; nonlinear mechanics. PREREQ: PHYS 5583, PHYS 5561 and PHYS 5562, or permission of instructor.

**PHYS 6624 Quantum Mechanics: 3 semester hours.**

Schrodinger wave equation, stationary state solution; operators and matrices; perturbation theory, non-degenerate and degenerate cases; WKB approximation, non-harmonic oscillator, etc.; collision problems. Born approximation, method of partial waves. PREREQ: PHYS 5561, PHYS 5562, and PHYS 6621 or permission of instructor.

**PHYS 6625 Quantum Mechanics: 3 semester hours.**

Schrodinger wave equation, stationary state solution; operators and matrices; perturbation theory, non-degenerate and degenerate cases; WKB approximation, non-harmonic oscillator, etc.; collision problems. Born approximation, method of partial waves. PREREQ: PHYS 6624 or permission of instructor.

**PHYS 6626 Advanced Quantum Mechanics: 3 semester hours.**

Elementary quantum field theory and practical applications. Emphasis upon non-relativistic and relativistic quantum electrodynamics, radiative processes, bremsstrahlung, pair-production, scattering, photo-electric effect, emission and absorption. PREREQ: PHYS 6625 or permission of instructor.

**PHYS 6630 Accelerator Physics: 3 semester hours.**

The physics of direct voltage accelerators, betatrons, synchrotrons, linear induction acceleration; high current accelerators; electromagnetic particle optics, free electron lasers and synchrotron light sources. PREREQ: PHYS 6612, and PHYS 6624 or equivalent.

**PHYS 6631 Accelerator Technology: 3 semester hours.**

Topics will include high voltage and pulsed power techniques, wave guide and R.F. structures, ion and electron beam sources and beam measurements as applied to particle beam machines. PREREQ: PHYS 6612 or equivalent.

**PHYS 6632 Particle Beam Laboratory: 1-4 semester hours.**

Laboratory projects in particle beam and ion optics, radiation detectors, ion source operation, etc. May be repeated up to 4 credits. PREREQ: Permission of instructor.

**PHYS 6640 Statistical Mechanics: 3 semester hours.**

Statistical ensembles; the Maxwell-Boltzmann law; approach to equilibrium, quantum statistical mechanics; application of statistical mechanics to thermodynamic processes. PREREQ: PHYS 5515 and PHYS 6621.

**PHYS 6641 Field Theory Particles and Cosmology I: 3 semester hours.**

Topics may include Dirac theory, group theory, Feynman diagrams, superstrings, supergravity, relativity and cosmology. PREREQ: Permission of instructor.

**PHYS 6642 Field Theory Particles and Cosmology II: 3 semester hours.**

A continuation of PHYS 6641. Topics may include Dirac theory, group theory, Feynman diagrams, superstrings, super gravity, relativity and cosmology. PREREQ: Permission of instructor.

**PHYS 6643 Advanced Solid State Physics: 3 semester hours.**

Electron many-body problem, crystal and reciprocal lattice, Bloch functions, pseudo potentials, semi-conductors, transition metals, crystal momentum and coordinate representations, electric and magnetic fields, impurities and defects in crystals and semi-conductors, radiation effects on solids, lattice vibrations, electron transport. PREREQ: PHYS 6624 or permission of instructor.

**PHYS 6648 Special Topics in Physics: 1-3 semester hours.**

Survey, seminar, or project (usually at an advanced level) in one area of physics. Content varies depending upon the desires of the students and faculty. May be repeated until 6 credits are earned. PREREQ: Permission of instructor.

**PHYS 6649 Graduate Seminar: 1 semester hour.**

Advanced seminar topics in currently-active areas of applied physics. Students will be required to provide presentations and may be required to submit a paper. Four credits required. May be repeated.

**PHYS 6650 Thesis: 1-10 semester hours.**

Thesis. May be repeated. Graded S/U.

**PHYS 6699 Experimental Course: 1-6 semester hours.**

The content of this course is not described in the catalog. Title and number of credits are announced in the Class Schedule. Experimental courses may be offered no more than three times with the same title and content. May be repeated.

**PHYS 8850 Doctoral Dissertation: 1-12 semester hours.**

Research toward and completion of the dissertation. Variable credits. May be repeated. Graded S/U.