PHYSICS (PHYS)

PHYS 501 Everyday Physics (4 Units)
Prerequisite: Permission of instructor. College-level physics content for future teachers. Inquiry, discovery, activities, discussion, and experiential learning take place in a laboratory/embedded-lecture environment. (Formerly 3650:501)

PHYS 506 Elements of Optics (3 Units)
Prerequisite: Permission of instructor. Selected topics in optics such as geometrical, wave (diffraction and interference, polarization, scattering etc.), and quantum optics (lasers); design of optical systems based on optical design platforms. (Formerly 3650:506)

PHYS 531 Mechanics (3 Units)
Prerequisite: Permission of instructor. Mechanics at an intermediate level. Newtonian mechanics, motion of a point particle, momentum and energy, oscillations, Lagrange's equations, central force problems, non-inertial frames, rotation of rigid bodies, coupled oscillators and normal modes. (Formerly 3650:531)

PHYS 532 Mechanics II (3 Units)
Prerequisite: Admission to Physics Master's program or permission. Advanced mechanics at the senior or beginning graduate level, moving coordinate systems, mechanics of continuous media. Lagrange's equations, tensor algebra and stress analysis, rotation or rigid bodies, vibration theory. (Formerly 3650:532)

PHYS 536 Electromagnetism (3 Units)
Prerequisite: Permission of instructor. Electricity and magnetism using vector calculus. Electrostatics and magnetostatics, electric and magnetic fields, dielectric and magnetic materials, electromagnetic induction, Maxwell's field equations in differential form, wave solutions. (Formerly 3650:536)

PHYS 537 Electromagnetism II (3 Units)
Prerequisite: Admission to Physics Master's program or permission. Special relativity, four vectors, Maxwell's equations in covariant form; propagation, reflection and refraction of electromagnetic waves; multipole radiation. (Formerly 3650:537)

PHYS 541 Quantum Physics (3 Units)
Prerequisite: Permission of instructor. Introduction to quantum theory, Schrödinger equation, observables, angular momentum, perturbation theory, variational principle, bound states, scattering theory, radiative interactions, spin, Pauli Exclusion Principle, applications of quantum mechanics to atomic, nuclear and solid state physics. (Formerly 3650:541)

PHYS 542 Quantum Physics II (3 Units)
Prerequisite: Admission to Physics Master's program or permission. Applications of quantum mechanics to atomic, nuclear and solid state physics. Tunneling and alpha decay, periodic potential, Hydrogen and Helium atoms, interatomic forces, quantum statistics. (Formerly 3650:542)

PHYS 551 Advanced Laboratory (3 Units)
Prerequisite: Permission of instructor. Experimental techniques, applicable to research-type projects in contemporary physics. Advanced scanning probe techniques including atomic force microscopy, electrostatic nanolithography, radioactive spectroscopy, and lasers. (Formerly 3650:551)

PHYS 552 Advanced Laboratory II (3 Units)
Prerequisite: Admission to Physics Master's program or permission. Experimental projects applicable to contemporary physics. Diode and dye lasers, laser feedback, chaos, NMR, electron tunneling, and fiber optics. (Formerly 3650:552)

PHYS 556 Techniques of Physics Instruction (0-1 Units)
Teaching assistants are introduced to current research in learning physics, shown applications for their labroom, and trained in skills needed as a laboratory teaching assistant. (Formerly 3650:556)

PHYS 570 Introduction to Solid-State Physics (3 Units)
Prerequisite: Admission to Physics Master's program or permission. Account of basic physical processes occurring in solids, with emphasis on fundamental relation between these processes and periodicity of crystalline lattice. (Formerly 3650:570)

PHYS 581 Methods of Mathematical Physics (3 Units)
Prerequisite: Permission of instructor. Survey of mathematical techniques useful in physics. Matrices, eigenvalues, vector analysis, ordinary and partial differential equations, Green's functions, complex variable theory, Fourier series, integral transforms. (Formerly 3650:581)

PHYS 582 Methods of Mathematical Physics II (3 Units)
Prerequisite: admission to Physics Master's program or permission. Vectors, generalized coordinates, tensors, calculus of variations, vector spaces, linear transformations, matrices, eigenvalues, Hilbert space, boundary value problems, transcendental functions, complex variables, analytic functions, Green's functions, integral equations. (Formerly 3650:582)

PHYS 588 Selected Topics: Physics (1-4 Units)
(May be repeated) Prerequisite: Permission. Consideration of selected topics, procedures, techniques, materials or apparatus of current interest in physics. (Formerly 3650:588)

PHYS 590 Workshop: Physics (1-4 Units)
(May be repeated.) Prerequisite: Permission. Further investigations of various selected topics in physics, under guidance of faculty member. (Formerly 3650:590)

PHYS 597 Independent Study: Physics (1-4 Units)
(May be repeated.) Prerequisite: Permission. Further investigations of various selected topics in physics, under guidance of faculty member. (Formerly 3650:597)

PHYS 598 Physics Colloquium (1 Unit)
Lectures on current research topics in physics by invited speakers. May be repeated, but only one credit counts toward M.S. degree. Credit/Noncredit. (Formerly 3650:598)

PHYS 605 Computer Physics: Numerical Solutions to Physics Problems I (3 Units)
Prerequisite: Permission. Review of FORTRAN and basic topics in computer science. Numerical solutions to physics problems, including Newton's and Schrodinger's equations. Treatment and reduction of experimental data, plotting, simulation. (Formerly 3650:605)

PHYS 606 Computer Physics: Numerical Solutions to Physics Problems II (3 Units)
Prerequisite: Admission to Physics Master's program or permission. Data reduction, Calcomp plotting, comparison of theoretical models with data, linear and non-linear least squares curve-fitting. May accommodate scientific problems of individual interest. (Formerly 3650:606)

PHYS 615 Electromagnetic Theory I (3 Units)
Prerequisite: Admission to Physics Master's program or permission. Electrostatics and magnetostatics at advanced level for graduate students, boundary value problems, dielectrics, multipole expansions, time-varying fields, Maxwell's equations and electromagnetic waves, reflection, refraction, wave guides and cavities. (Formerly 3650:615)

PHYS 616 Electromagnetic Theory II (3 Units)
Prerequisite: Admission to Physics Master's program or permission. Scattering and diffraction, plasma physics, special theory of relativity, dynamics of relativistic particles in fields, collisions of charged particles, radiation from moving charges, bremsstrahlung, multipole fields. (Formerly 3650:616)

PHYS 625 Quantum Mechanics I (3 Units)
Prerequisite: Admission to Physics Master's program or permission. Basic concepts of quantum mechanics, representation theory, particle in a central field, addition of angular momenta and spins, Clebsch-Gordon coefficients, perturbation theory, scattering, transition probabilities. (Formerly 3650:625)

PHYS 626 Quantum Mechanics II (3 Units)
Prerequisite: Admission to Physics Master's program or permission. Foundations of relativistic quantum mechanics. Klein-Gordon and Dirac equations, spin-zero and spin-1/2 particles in electromagnetic field, second quantization of bosons and fermions, superfluidity and super conductivity. (Formerly 3650:626)

PHYS 630 Advanced Laboratory Techniques of Materials Characterication (3 Units)
Prerequisite: Admission to the physics master's program or permission. This course focuses on the characterization of thin films and surfaces of materials. Techniques include Atomic Force Microscopy, UV-visible, FTIR, Photoluminescence, and Electron Tunneling spectroscopies. (Formerly 3650:630)

PHYS 631 Quantum Mechanics of Molecules and Materials (3 Units)
Prerequisite: Admission to the physics master's program or permission. An applied quantum mechanics course that is also relevant for engineers, materials scientist, and applied physicists. (Formerly 3650:631)

PHYS 632 Thermodynamics and Statistical Mechanics of Materials (3 Units)
Prerequisite: Admission to the physics master's program or permission. Fundamental laws of thermodynamics and their applications to material systems; criteria for equilibrium; the statistical mechanics of solids. (Formerly 3650:632)

PHYS 641 Lagrangian Mechanics (3 Units)
Prerequisite: Admission to Physics Master's program or permission. Principle of least action and Lagrangian equation of motion, conservation laws, integration of equation of motion, collisions, small oscillations, Hamilton's equations, canonical transformations. (Formerly 3650:641)

PHYS 661 Statistical Mechanics (3 Units)
Prerequisite: Admission to Physics Master's program or permission. Fundamental principles of statistical mechanics, Gibbs, Fermi and Bose Statistics, solids, liquids, gases, phase equilibrium, chemical reactions. (Formerly 3650:661)

PHYS 662 Thermodynamics & Statistical Mechanics II (3 Units)
See department for course description. (Formerly 3650:662)

PHYS 670 Biological Physics (3 Units)
Prerequisite: Admission to the physics master's program or permission. Explores the physics of biological systems, especially on the molecular scale: structural properties and transport processes, self-assembly, and molecular motors. (Formerly 3650:670)

PHYS 671 Computational Materials Physics (3 Units)
Prerequisites: Admission to the physics master's program or permission. Introduces current computational techniques including computer simulations to investigate structural and transport properties of condensed matter systems. (Formerly 3650:671)

PHYS 672 Nanomaterials (3 Units)
Prerequisites: Admission to the physics master's program or permission. Structures and characterizations of nanomaterials. Physical properties of nanomaterials. Carbon based nanomaerials. Nanoscale device applications. (Formerly 3650:672)

PHYS 673 Advanced Condensed Matter Physics (3 Units)
Prerequisite: Admission to the physics master's program of permission. Response of materials to external perturbations (e.g. electromagnetic radiation); elementary excitations; semiconductors; magnetism; superconductivity. (Formerly 3650:673)

PHYS 674 Physics of Photonics (3 Units)
Prerequisites: Admission to the physics master's program or permission. This theoretical course focuses on understanding the physics of photonics and light-matter interactions, with potential applications to many interdisciplinary areas of science and technology. (Formerly 3650:674)

PHYS 685 Solid-State Physics I (3 Units)
Prerequisite: Admission to Physics Master's program or permission. Theory of physics of crystalline solids. Properties of reciprocal lattice and Bloch's theorem. Lattice dynamics and specific heat. Electron states; cellular method, tight-binding method, Green's function method. (Formerly 3650:685)

PHYS 686 Solid-State Physics II (3 Units)
Prerequisite: Admission to Physics Master's program or permission. Orthogonalized plane and pseudo potentials. Electron-electron interaction; screening by impurities. Friedel sum rule and plasma oscillations. Dynamics of electrons, transport properties and Fermi surface. (Formerly 3650:686)

PHYS 689 Special Problems in Theoretical Physics (1-4 Units)
(May be repeated.) Prerequisite: Permission. Intended to facilitate expansion of particular areas of interest in theoretical physics, by consultation with faculty member and independent study beyond available course work. (Formerly 3650:689)

PHYS 691 Seminar in Theoretical Physics (1-3 Units)
(May be repeated.) Prerequisite: Permission. (Formerly 3650:691)

PHYS 697 Graduate Research in Physics (1-5 Units)
Prerequisite: Permission. Candidates for M.S. degree may obtain up to five credits for faculty supervised research projects. Grades and credit received at completion of such projects. (Formerly 3650:697)

PHYS 698 Special Topics in Physics (1-4 Units)
Prerequisite: Permission. Enables student who needs information in special areas, in which no formal course is offered, to acquire knowledge in these areas. (Formerly 3650:698)

PHYS 699 Master's Thesis (1 Unit)
Prerequisite: Permission. With approval of department, one credit may be earned by candidate for M.S. degree upon satisfactory completion of a master's thesis. (Formerly 3650:699)

PHYS 710 Surface Physics (3 Units)
Prerequisite: PHYS 470. An interdisciplinary course stressing the fundamentals and applications of physics at surfaces, including corrosion, catalysis, adhesion, and tribology. (Formerly 3650:710)

PHYS 769 Critical Phenomena & Phase Transitions (3 Units)
Prerequisites: PHYS 625, PHYS 641, and PHYS 661. Modern theory of critical phenomena. Landau theory. Spin systems, binary mixtures, polymers and liquid crystals. Multicomponent systems. Multicritical points. Renormalization. Epsilon-expansions of critical exponents. (Formerly 3650:769)

PHYS 879 Doctoral Research (1-15 Units)
(May be repeated.) Prerequisite: Approval of the Student Advisory Committee for Ph.D. research in physics, physical chemistry, polymer science, applied mathematics or electrical engineering. Original research by a Ph.D. candidate in various disciplines under the guidance of physics faculty. (Formerly 3650:879)