PHYSICS

Physics is a natural science that seeks to understand matter and interactions in space and time. A good understanding of physics is essential for students who plan to contribute to our knowledge of the natural world and to the development of emerging technologies.

The Physics Department of the University of Akron consists of 5 full-time faculty members teaching a range of courses for students studying in other fields.

All of our faculty are active in research and try to involve students in research as soon as possible so they can gain valuable experience. Several of our faculty have joint appointments in Ph.D.-granting departments whose research interests overlap with ours. This offers considerable scope for interdisciplinary research.

- Physics, Minor (https://bulletin.uakron.edu/undergraduate/colleges-programs/arts-sciences/physics/physics-minor/)

Physics (PHYS)

PHYS 130 Descriptive Astronomy (4 Units)
Qualitative introduction to astronomy, intended primarily as a first science course for non-science majors. Includes laboratory and observational activities. (Formerly 3650:130)
Ohio Transfer 36: Yes
Gen Ed: Natural Science with Lab

PHYS 132 Physics of Sound (3 Units)
Qualitative introduction to the physics of sound, its properties, perception and reproduction, including acoustical principles of musical instruments; virtual activities included.
Gen Ed: Natural Science

PHYS 133 Music, Sound & Physics (4 Units)
Qualitative introduction to the physics of sound, its properties, perception and reproduction, including acoustical principles of musical instruments. Laboratory and observational activities included. (Formerly 3650:133)
Ohio Transfer 36: Yes
Gen Ed: Natural Science with Lab

PHYS 137 Light (4 Units)
Introductory, qualitative course dealing with the nature of light and the interaction of light with various materials to produce common visual effects. Laboratory activities provide experience in scientific investigation. (Formerly 3650:137)
Ohio Transfer 36: Yes
Gen Ed: Natural Science with Lab

PHYS 150 Manufacturing Physics (4 Units)
Prerequisite: Admission to the Manufacturing Engineering Technology program. Corequisite: MATH 154. Applications of physics to manufacturing including two dimensional motion, vectors, forces, statics, torque and simple electronic circuits. Laboratory. (Formerly 3650:150)

PHYS 160 Technical Physics: Mechanics (4 Units)
Corequisite: MATH 154. Applications of mechanics which include one and two dimensional motion, vectors, forces, equilibrium, work, power, conservation of energy, rotational motion & torque. Laboratory (Formerly 3650:160)
Ohio Transfer 36: Yes

PHYS 161 Technical Physics: Mechanics I (2 Units)
Corequisite: MATH 153. Principles of mechanics that include motion, vectors, forces, equilibrium; also significant figures and unit conversions. Laboratory. (Formerly 3650:161)

PHYS 162 Technical Physics: Mechanics II (2 Units)
Prerequisites: MATH 153 and PHYS 161. Principles of mechanics that include work, power, conservation of energy, rotational motion, torque. Laboratory. (Formerly 3650:162)

PHYS 163 Technical Physics: Electricity & Magnetism (2 Units)
Prerequisites: MATH 154 and PHYS 160 with a grade of C- or better in both. Principles and applications of electricity and magnetism. Electrostatics, DC circuits, magnetism, electromagnetism, and AC circuits. Laboratory. (Formerly 3650:163)
Ohio Transfer 36: Yes

PHYS 164 Technical Physics: Heat & Light (2 Units)
Prerequisites: [PHYS 160 with a grade of C- or better] and MATH 154. Principles and applications of heat and light: heat energy, thermodynamics, electromagnetic waves, geometric and physical optics, introduction to quantum mechanic, and radiation. (Formerly 3650:164)
Ohio Transfer 36: Yes
Gen Ed: Natural Science

PHYS 261 College Physics I (4 Units)
Prerequisites: MATH 143, MATH 144, or MATH 145 with a grade of C- or better, or placement . First course in physics using methods of algebra and trigonometry. The course includes the study of motion in one and two dimensions, and the applications of the concepts of force, work, energy, and momentum to linear and rotational motion. Simple harmonic motion, waves, and properties of solids, fluids, and gases are also explored. (Formerly 3650:261)
Gen Ed: Natural Science with Lab

PHYS 262 College Physics II (4 Units)
Prerequisite: PHYS 160 or PHYS 261. Second course in physics using methods of algebra and trigonometry. The course includes optics, electricity and magnetism, simple circuit analysis, and thermal physics. Elementary concepts of quantum mechanics are explored and applied to atomic and nuclear physics. (Formerly 3650:262)
Gen Ed: Natural Science with Lab

PHYS 267 Life Science Physics Computations I (1 Unit)
Corequisites: PHYS 261. Optional companion courses to PHYS 261 and PHYS 262 provides additional computational experience in applications of physics to life sciences, emphasizing use of algebra and trigonometry. Particularly recommended for student with modest mathematical preparation. (Formerly 3650:267)

PHYS 268 Life Science Physics Computations II (1 Unit)
Corequisites: PHYS 262. Optional companion courses to PHYS 261 and PHYS 262 provides additional computational experience in applications of physics to life sciences, emphasizing use of algebra and trigonometry. Particularly recommended for student with modest mathematical preparation. (Formerly 3650:268)

PHYS 291 Elementary Classical Physics I (4 Units)
Prerequisite: Completion of MATH 221 with a grade of 'C-' or better, or AP Calculus AB, or BC test score of 3 or better. Introductory physics for students of science and engineering. Classical kinematics and dynamics as related to contemporary physics. Oscillations, thermodynamics. Vectors and some calculus introduced as needed. Includes laboratory activities. (Formerly 3650:291)
Ohio Transfer 36: Yes
Gen Ed: Natural Science with Lab

PHYS 292 Elementary Classical Physics II (4 Units)
Prerequisite: PHYS 291. Fluid mechanics, mechanical and electromagnetic waves and wave phenomena, basic laws of electromagnetism, interference and diffraction, coherence, geometrical and physical optics. Includes laboratory activities. (Formerly 3650:292)
Ohio Transfer 36: Yes
Gen Ed: Natural Science with Lab

PHYS 293 Physics Computations I (1 Unit)
Corequisite: PHYS 291. Optional companion courses to PHYS 291 and PHYS 292 provides experience in problem solving, and elaborates application of calculus to simple physical phenomena. Particularly recommended for a freshman and for student with modest preparation in mathematics or physical sciences. (Formerly 3650:293)

PHYS 294 Physics Computations II (1 Unit)
Corequisite: PHYS 292. Optional companion courses to PHYS 291 and PHYS 292 provides experience in problem solving, and elaborates application of calculus to simple physical phenomena. Particularly recommended for a freshman and for student with modest preparation in mathematics or physical sciences. (Formerly 3650:294)

PHYS 301 Modern Physics (3 Units)
Prerequisite: PHYS 292. Special relativity, introduction to quantum physics, hydrogen atom, atomic physics, selected applications of quantum physics. (Formerly 3650:301)

PHYS 322 Intermediate Laboratory I (3 Units)
Prerequisites: [PHYS 262 and MATH 221] or PHYS 292. Modern physics experiments focusing on electronic phenomena such as: electron charge/mass ratio, semiconductor devices, superconductivity, and energy quantization. (Formerly 3650:322)

PHYS 323 Intermediate Laboratory II (3 Units)
Prerequisites: [PHYS 262 and MATH 221] or PHYS 292. Contemporary experiments focusing on optical phenomena such as: interference, diffraction, holography, fiber optics, and spectroscopy. (Formerly 3650:323)

PHYS 340 Thermal Physics (3 Units)
Prerequisite: PHYS 262 or PHYS 292. Basic principles of thermal and statistical physics. Ensembles, laws of thermodynamics, equilibrium, irreversibility, equipartition theorem, canonical distribution, Maxwell distribution, phase changes, cyclic processes, transport processes. (Formerly 3650:340)

PHYS 350 Modeling & Simulation (4 Units)
Prerequisites: [PHYS 262 or PHYS 292] and MATH 221. Corequisite: MATH 222. Interdisciplinary course stressing modeling of natural phenomena using fundamental principles and their simulation. Topics may include oscillations and chaos, random systems, potentials and fields, wave phenomena. (Formerly 3650:350)

PHYS 399 Undergraduate Research (1-6 Units)
(May be repeated) Prerequisite: Permission of instructor. Participation in current research project in department under supervision of faculty member. (Formerly 3650:399)

PHYS 401 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 3650:401)

PHYS 406 Elements of Optics (3 Units)
Prerequisites: PHYS 292 and MATH 335. 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.

PHYS 431 Mechanics (3 Units)
Prerequisites: PHYS 291 and MATH 335. 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 3650:431)

PHYS 432 Mechanics II (3 Units)
Prerequisite: PHYS 431. 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 of rigid bodies, vibration theory. (Formerly 3650:432)

PHYS 436 Electromagnetism (3 Units)
Prerequisites: PHYS 292 and MATH 335 or 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 3650:436)

PHYS 437 Electromagnetism II (3 Units)
Prerequisite: PHYS 436. Special relativity, four vectors, Maxwell's equations in covariant form; propagation, reflection and refraction of electromagnetic waves; multipole radiation. (Formerly 3650:437)

PHYS 441 Quantum Physics (3 Units)
Prerequisites: PHYS 301 and MATH 335. 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 3650:441)

PHYS 442 Quantum Physics II (3 Units)
Prerequisite: PHYS 441. 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 3650:442)

PHYS 451 Advanced Laboratory (3 Units)
Prerequisite: PHYS 323. 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 3650:451)

PHYS 452 Advanced Laboratory II (3 Units)
Prerequisite: PHYS 323 or permission of instructor. Experimental projects applicable to contemporary physics. Diode and dye lasers, NMR, SPM, chaos, electron tunneling and fiber optics. (Formerly 3650:452)

PHYS 470 Introduction to Solid-State Physics (3 Units)
Prerequisite: PHYS 441. Account of basic physical processes occurring in solids, with emphasis on fundamental relation between these processes and periodicity of crystalline lattice. (Formerly 3650:470)

PHYS 481 Methods of Mathematical Physics (3 Units)
Prerequisites: PHYS 292 and MATH 335. 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 3650:481)

PHYS 482 Methods of Mathematical Physics II (3 Units)
Prerequisites: PHYS 292, MATH 335 and senior or graduate standing in a physical science or engineering. 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 3650:482)

PHYS 488 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 3650:488)

PHYS 490 Workshop: Physics (1-4 Units)
(May be repeated) Group studies of special topics in physics. May not be used to meet undergraduate or graduate major requirements in physics. May be used for elective credit only. (Formerly 3650:490)

PHYS 491 Capstone Project in Physics A (2 Units)
Prerequisites: PHYS 301 and MATH 335 and permission. Proposal phase of a capstone research project in physics or a research topic relevant to physics, supervised by a faculty member of the department.
Gen Ed: Capstone

PHYS 492 Capstone Project in Physics B (2-4 Units)
Prerequisite: Permission. Pre/Corequisite: PHYS 491. Final phase of a capstone research project in physics or a research topic relevant to physics, supervised by a faculty member of the department. (Formerly 3650:492)

PHYS 497 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 3650:497)

PHYS 498 Physics Colloquium (1 Unit)
Lectures on current research topics in physics by invited speakers. May be repeated but only one credit counts toward the M.S. Degree. Offered on a credit/noncredit basis only. (Formerly 3650:498)

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)