Course Descriptions

PHYS 5100 Current Topics In Physics (1 semester hour) Study of current research topics in physics. (P/F grading, may be repeated for credit.) (1-0) R
PHYS 5V49 Special Topics In Physics (1-6 semester hours) Topics may vary from semester to semester. (May be repeated for credit to a maximum of 9 hours.) ([1-6]-0) R
PHYS 5283 (EE 5283) Plasma Technology Laboratory (2 semester hours) Laboratory will provide a "hands-on" experience to accompany PHYS 5383. Topics to include: vacuum technology [pumps, gauges, gas feed], plasma uses [etch, deposition, lighting and plasma thrusters] and introductory diagnostics. Corequisite: PHYS 5383, Recommended Co-requisite: PHYS 7171. (0-6) R
PHYS 5304 Proposal And Report Preparation (3 semester hours) A discussion of techniques for writing successful proposals and formal reports. Topics include types of proposals, the importance of logical organization and outlines, interpretation of RFPs, preparation and submission of unsolicited proposals, elements of writing style, statements of work and milestones, estimation of project timelines, and the importance of accurate cost estimates. (3-0) R
PHYS 5305 Monte Carlo Simulation Method and its Application (3 semester hours) An introductory course on the method of Monte Carlo simulation of physical events. This course covers the generation of 0-1 random number, simulation of arbitrary distributions, modeling, simulation and statistical analysis of experimental activities in physics research and engineering studies. As a comparison the concepts and applications of the Neural Networks will be discussed. Prerequisite: Calculus (MATH 2417), Statistics (MATH 1342), C (CS 3335) or FORTRAN programming languages. (3-0) T
PHYS 5411 Classical Mechanics (4 semester hours) A course that aims to provide intensive training in problem solving. Rigorous survey of Newtonian mechanics of systems, including its relativity principle and applications to cosmology; the ellipsoid of inertia and its eigenstructure, with applications, Poinsot's theorem; Euler's equations, spinning tops; Lagrangian and Hamiltonian formalism with applications; chaos, small oscillations, velocity dependent potentials, Lagrange multipliers and corresponding constraint forces, canonical transformations, Lagrange and Poisson brackets, Hamilton-Jacobi theory.(4-0) Y
PHYS 5413 Statistical Physics (4 semester hours) Phase space, distribution functions and density matrices; Microcanonical, canonical and grand canonical ensembles; Partition functions; Principle of maximum entropy; Thermodynamic potentials and laws of thermodynamics; Classical and quantum ideal gases; Non-interacting magnetic moments; Phonons and specific heat of solids; Degenerate electron gas, its specific heat and magnetism; Statistics of carriers in semiconductors; Bose-Einstein condensation; Black-body radiation; Boltzmann transport equation and H-theorem; Relaxation time and conductivity; Brownian motion, random walks and Langevin equation; Einstein's relation; Fluctuations in ideal gases; Linear response and fluctuation-dissipation theorem; Virial and cluster expansions, van der Waals equation of state; Poisson-Boltzmann and Thomas-Fermi equations; Phases, phase diagrams and phase transitions of the first and second order; Lattice spin models; Ordering, order parameters and broken symmetries; Mean-field theory of ferromagnetism; Landau and Ginzburg-Landau theories; Elements

of modern theory of critical phenomena. (4-0) T

PHYS 5317 Atoms, Molecules And Solids I (3 semester hours) Core course for Applied Physics Concentration. Fundamental physical description of microsystems starting with the need for quantum mechanics and proceeding through the application of quantum mechanics to atomic systems. Emphasis will be on a physical understanding of the principles which apply to technologically important devices. Computer simulations will be used to focus the student on the important physical principals and not on detailed exact solutions to differential equations. Topics covered include: Justification for quantum mechanics, application of quantum mechanics to one-electron problems, application to multi-electron problems in atomic systems. Prerequisite: MATH 2451, PHYS 2325, and PHYS 2326, or PHYS 2327. (3-0) Y

PHYS 5318 Atoms, Molecules And Solids II (3 semester hours) Core course for Applied Physics Concentration. Application of quantum mechanics to molecules and solids. Topics in solids include optical, thermal, magnetic and electric properties, impurity doping and its effects on electronic properties, superconductivity, and surface effects. Various devices, such as, transistors, FET's, quantum wells, detectors and lasers will also be discussed. PHYS 5317, or equivalent. (3-0) Y

PHYS 5321 Experimental Operation And Data Collection Using Personal Computers (3 semester hours) Computer interfacing to physical experiments using high level interface languages and environments. The student will have the opportunity to learn how to develop data acquisition software using LabView and LabWindows/CVI as well as how to write drivers to interface these languages to devices over the general purpose interface buss (GPIB). A laboratory is provided for hands-on training in these devices. (3-0) R

PHYS 5422 Electromagnetism II (4 semester hours) Fields and Potentials, Gauge transformations and the Wave Equation Electromagnetic waves in unbounded media – non-dispersive and dispersive media Boundary conditions at interfaces. Solutions to the wave equation in rectangular cylindrical and spherical coordinates. Electromagnetic waves in bonded media – waveguides and resonant cavities. Radiating systems – electric and magnetic dipole radiation, electric quadrupole radiation. Fundamentals of scattering and scalar diffraction.

Lorentz transformation and covariant forms for Maxwell's equations. Radiation from moving charges – Synchrotron, Cherenkov and Bremstrahlung Radiation Pre-requisite PHYS 5421 or equivalent. (4-0) Y

PHYS 5323 Virtual Instrumentation with Biomedical Clinical and Healthcare Applications (3 semester hours) The application of the graphical programming environment of LabView will be demonstrated with examples related to the health care industry. Examples will be provided to highlight the use of the personal computer as a virtual instrument in the clinical and laboratory environment. A laboratory is provided for hands-on training to augment the lecture. (3-0)R

PHYS 5324 Computer Interfacing And Data Acquisition (3 semester hours) Hardware and software operation of various devices which interface computers into physical experiments. The student will have the opportunity to learn how to program personal computers using the C and C++ programming language for data acquisition and control of experiments. The operation of digital input and output devices, analog to digital converters, digital to analog converters, counters, and timers will be discussed as well as the operation of intelligent controllers over the general purpose interface buss (GPIB). A laboratory is provided for hands-on training in these devices.(3-0) Y

PHYS 5351 Basic Aspects and Practical Applications of Spectroscopy. (3 semester hours) Atomic and Molecular spectroscopy has played a pivotal role in our understanding of atomic structure and in the formulation of quantum mechanics. The numerous and rapidly growing field of spectroscopic applications spans many disciplines. Topics included in course: atomic structure; spin-orbit interactions and coupling; influence of applied fields; molecular bands, vibrations and rotations; selection rules and intensities. Laboratory exercises focus on acquisition and interpretation of spectroscopic signatures from active plasmas and on spectroscopic techniques suitable for surface analysis. (2-3) R

PHYS 5361 (EE 6309) Fourier Optics (3 semester hours) Theory of diffraction and coherence; experiments with Gaussian beams and modes. Prerequisite: PHYS 4328 or equivalent. (3-0) R

PHYS 5367 Photonic Devices (3 semester hours) Basic principles of Photophysics of Condensed Matter with application to devices. Topics covered include photonic crystals, PBG systems, low threshold lasers, photonic switches, Super-prisms and super-lenses. Photodetectors and photocells. (3-0) R

PHYS 5369 Special Topics in Applied Physics (3 semester hours) Topics may vary from semester to semester. (May be repeated for credit up to a maximum of 9 hours.) (3-0) R

PHYS 5371 (MSEN 5371) Solid State Physics (3 semester hours) Symmetry description of crystals, bonding, properties of metals, electronic band theory, thermal properties, lattice vibration, elementary properties of semiconductors. Prerequisites: PHYS 5400 and 5421 or equivalent. (3-0) Y

PHYS 5372 Solid State Devices (3 semester hours) Basic concepts of solid state physics with application to devices. Topics covered include semiconductor homojunctions and heterojunctions, low dimensional physics, one and two dimensional electron gases, hot electron systems, semiconductor lasers, field effect and heterojunction transistors, microwave diodes and infrared and solar devices. Prerequisite: PHYS 5318 (3-0) T

PHYS 5375 (MSEN 5375) Electronic Devices Based On Organic Solids (3 semester hours) Solid state device physics based on organic condensed matter structures, including: OLEDs (organic light emitting diodes), organic FETs, organic lasers, plastic photocells, molecular electronic chips. (3-0) R

PHYS 5376 (MSEN 5300) Introduction to Materials Science (3 semester hours) This course provides an intensive overview of materials science and engineering and includes the foundations required for further graduate study in the field. Topics include atomic structure, crystalline solids, defects, failure mechanisms, phase diagrams and transformations, metal alloys, ceramics, polymers as well as their thermal, electrical, magnetic and optical properties. (3-0) R

PHYS 5377 Computational Physics of Nanomaterials (3 Semester hours) This course introduces atomistic and quantum simulation methods to study nanomaterials. Three main themes are covered: structure-property relationship of nanomaterials; atomistic modeling for atomic structure optimization; and quantum simulations for electronic structure study and functional property analysis. Prerequisites: PHYS 5411, 5305, 6400 or equivalent.

PHYS 5381 Space Science (3 semester hours) Introduction to the dynamics of the middle and upper atmospheres, ionospheres and magnetospheres of the earth and planets and the interplanetary medium. Topics include: turbulence and diffusion, photochemistry, aurorae and airglow, space weather and the global electric circuit. (3-0) T

PHYS 5382 Space Science Instrumentation (3 semester hours) Design, testing and operational criteria for space flight instrumentation including retarding potential analyzers, drift meters, neutral and ion mass spectrometers, auroral particle spectrometers, fast ion mass spectrometers, Langmuir probes, and optical spectrometers; ground support equipment; microprocessor design and operations. (3-0) R

PHYS 5383 (MSEN 5383 and EE 5383)Plasma Technology (3 semester hours) Hardware oriented study of useful laboratory plasmas. Topics will include vacuum technology, gas kinetic theory, basic plasma theory and an introduction to the uses of plasmas in various industries. (3-0) R.

PHYS 5385 Natural And Anthropogenic Effects On The Atmosphere (3 semester hours) An examination of the physical, chemical and electrical effects on the atmosphere and clouds due to varying solar photon and solar wind inputs; and of the physical and chemical effects on ozone and atmospheric temperature following anthropogenic release of CFC's and greenhouse gases into the atmosphere. Suitable for Science Education and other non-physics majors. (3-0) R

PHYS 5391 Relativity I (3 semester hours) Mach's principle and the abolition of absolute space; the principle of relativity; the principle of equivalence; basic cosmology; four-vector calculus; special relativistic kinematics, optics, mechanics, and electromagnetism; basic ideas of general relativity. (3-0) T

PHYS 5392 Relativity II (3 semester hours) Tensor calculus and Riemannian geometry; mathematical foundation of general relativity; the crucial tests; fundamentals of theoretical relativistic cosmology; the Friedmann model universes; comparison with observation. (Normally follows PHYS 5391.) (3-0) T

PHYS 5395 Cosmology (3 semester hours) The course is an overview of contemporary cosmology including: cosmological models of the universe and their parameters; large scale structure of the universe; dark matter; cosmological probes and techniques such as gravitational lensing, cosmic microwave background radiation, and supernova searches; very early stages of the universe; dark energy and recent cosmic acceleration. (3-0) T

PHYS 5401 Mathematical Methods Of Physics I (4 semester hours) Vector analysis and calculus, general curvilinear coordinates, tensor analysis, linear and matrix algebra, group theory, infinite series, and functions of a complex variable (including contour integration and the residue theorem). (4-0) Y

PHYS 5402 Mathematical Methods of Physics II (4 semester hours) Ordinary and partial differential equations, Sturm-Liouville theory of differential equations and orthogonal functions, special functions including Bessel, Legendre, Laguerre, Hermite, Chebyshev, and Hypergeometric functions, the Gamma and Beta functions, Fourier series, integral transformations, and Green's functions. (4-0) Y

PHYS 5406 Mathematical Methods of Applied Physics (4 semester hours) Elements of applied mathematics relevant to real world applications, including vector calculus, linear algebra, transforms, differential equations, and numerical solutions of differential equations. (4-0) Y

PHYS 5416 Applied Numerical Methods (4 semester hours) Core course for Applied

Physics Concentration. A hands-on approach to the development and use of computational tools in solving problems routinely encountered in upper level applied physics and engineering. Main topics include curve fitting and regression analysis, significance tests, principles of numerical modeling, verification and validation of numerical algorithms, and nonlinear model building. Examples from real world applications will be presented and discussed to illustrate the appropriate use of numerical techniques. Prerequisites: PHYS 5401 or equivalent, and proficiency in a programming language. (4-0) Y

PHYS 5421 Electromagnetism I (4 semester hours) Electrostatic boundary value problems, uniqueness theorems, method of images, Green's functions, multipole potentials, Legendre polynomials and spherical harmonics, dielectric and magnetic materials, magnetostatics, time-varying field and Maxwell's equations, energy and momentum of the field, Lienard-Wiechert potentials, electromagnetic radiation, polarization, refraction and reflection at plane interfaces. (4-0) Y

PHYS 5425 Applied Electromagnetics I (4 semester hours) Boundary value problems, method of images, Green's functions, multipole potentials, Bessel Functions, Legendre polynomials and spherical harmonics, dielectric and magnetic materials, magnetostatics, time-varying field and Maxwell's equations, energy and momentum of the field, electromagnetic radiation, polarization, refraction and reflection at plane interfaces.(4-0)Y

PHYS 5426 Applied Electromagnetics II (4 semester hours) Course content emphasizes advanced concepts in applied electromagnetism, including microwaves, magnetrons, propagation in anisotropic media, elementary scattering theory, antenna systems, waveguides, and optic fibers. Examples of real physical systems will be provided and examined. Software simulations will be used to study specific devices and applications. Prerequisites: PHYS 5425 and PHYS5401. (4-0) Y

PHYS 6283 (EE 6283) Plasma Physics Laboratory (2 semester hours) Laboratory will provide a "hands-on" experience to accompany PHYS 6383. Experiments will include measurements of fundamental plasma properties and understanding of important plasma diagnostics. Corequisite: PHYS 6383, Recommended Co-requisite: PHYS 7171. (0-6) T

PHYS 6400 Quantum Mechanics I (4 semester hours) Dirac formalism, kets, bras, operators and position, momentum, and matrix representations, change of basis, Stern-Gerlach experiment, observables and uncertainty principle, translations, wave functions, time evolution, the Schrödinger and Heisenberg pictures, simple harmonic oscillator, wave equation, WKB approximation, rotations, angular momentum, spin, Clebsch-Gordan coefficients, perturbation theory, variational methods. Prerequisite: PHYS 5411 or consent of the instructor. (4-0) Y

PHYS 6401 Quantum Mechanics II (4 semester hours) Non-relativistic many-particle systems and their second quantization description with creation and annihilation operators; Interactions and Hartree-Fock approximation, quasi-particles; Attraction of fermions and superconductivity; Repulsion of bosons and superfluidity; Lattice systems, classical fields and canonical quantization of wave equations; Free electromagnetic field, gauges and quantization: photons; Coherent states; Interaction of light with atoms and condensed systems: emission, absorption and scattering; Vacuum fluctuations and Casimir force; Elements of relativistic quantum mechanics: Klein-Gordon and Dirac equations; Particles and antiparticles; Spin-orbit coupling; Fine structure of the hydrogen atom; Micro-causality and spin-statistics theorem; Non-relativistic scattering theory: scattering amplitudes, phase shifts, cross-section and optical theorem; Born series; Inelastic and resonance scattering; Perturbative analysis of the interacting fields: Time evolution and interaction representation, S-matrix and Feynman diagrams; Simple scattering processes; Dyson's equation, self-energy and renormalization. Prerequisite: PHYS 6400. (4-0) Y

PHYS 6303 Applications Of Group Theory In Physics (3 semester hours) Group representation theory and selected applications in atomic, molecular and elementary-particle physics. Survey of abstract group theory and matrix representations of SU(2) and the rotation group, group theory and special functions, the role of group theory in the calculation of energy levels, matrix elements and selection rules, Abelian and non-Abelian gauge field theories, the Dirac equation, representations of SU(3), and the Standard Model of elementary-particle physics. Prerequisite: PHYS 5401. (3-0) Y

PHYS 6309 Special Topics In Mathematical Methods of Physics (3 semester hours) Topics vary from semester to semester. (May be repeated for credit to a maximum of 9 hours.) (3-0) R

PHYS 6311 Relativistic Quantum Field Theory I (3 semester hours) Classical fields; relativistic quantum mechanics of spin 0 and 1/2 particles; Klien-Gordon and Dirac equations; fundamentals of quantum field theory and quantum electrodynamics; second quantization; spin and statistics; covariant perturbation theory; Mott scattering; annihilation and Compton scattering; Feynman graphs; Moller scattering; mass and charge renormalization. (Normally follows PHYS 6300 or 6301.) (3-0) R

PHYS 6312 Relativistic Quantum Field Theory II (3 semester hours) Introduction to Gauge Theories, Weinberg-Salam model of electroweak interactions, spontaneous symmetry breaking, introduction to QCD, renormalization theory. Prerequisite: PHYS 6311. (3-0) R

PHYS 6313 Elementary Particles (3 semester hours) Elementary particles and their interaction; classification of elementary particles; fermions and bosons; particles and antiparticles; leptons and hadrons; mesons and baryons; stable particles and resonances; hadrons as composites of quarks and anti-quarks; fundamental interactions and fields; electromagnetic, gravitational, weak and strong interactions; conservation laws in fundamental interactions; parity, isospin, strangeness, G-parity; helicity and chirality; charge conjugation and time reversal; strong reflection and CPT theorem; gauge invariance; quarks and gluons; discovery of c, b and t quarks and the W+ and Z° particles; recent discoveries. (Normally follows PHYS 6300 or 6301.) (3-0) T

PHYS 6314 High Energy Physics (3 semester hours) Electromagnetic and nuclear interactions of particles with matter; particle detectors; accelerators and colliding beam machines; invariance principles and conservation laws; hadron-hadron interactions; static quark model of hadrons; weak interactions; lepton-quark interactions; the parton model of hadrons; fundamental interactions and their unification; generalized gauge invariance; the Weinberg-Salam Model and its experimental tests: quantum chromo-dynamics; quark-quark interactions; grand unification theories; proton decay, magnetic monopoles, neutrino oscillations and cosmological aspects; supersymmetries. (Normally follows PHYS 6313.) (3-0) T

PHYS 6316 High Energy Physics Instrumentation (3 semester hours) High energy accelerators and colliders; electromagnetic interaction of charged particles and photons with matter; nuclear interactions with matter; particle counters, track detectors, show detectors and calorimeters; data acquisition, trigger, and data handling and analysis systems; design and construction of complex high-energy physics detectors. (3-0) T

PHYS 6318 High Energy Accelerators (3 semester hours) Cyclic accelerators (synchrotrons); proton and electron synchrotrons; focusing and beam stability; linear accelerators (linacs); colliders; hadron and electron colliders; cooling in pp colliders; accelerator complexes. (3-0) R

PHYS 6339 Special Topics In Quantum Electronics (3 semester hours) Topics vary from semester to semester. (May be repeated for credit to a maximum of 9 hours.) (3-0) R

PHYS 6341 Nuclear Physics I: The Principles Of Nuclear Physics (3 semester hours) Atomic physics; atomic spectra, x-rays and atomic structure. The constitution of the nucleus; isotopes, natural radioactivity, artificial nuclear disintegration and artificial radioactivity; alpha-, beta-, and gamma-decay; nuclear reactions, nuclear forces and nuclear structure. Nuclear models, neutron physics and nuclear fission. (3-0) T

PHYS 6342 Nuclear Physics II: Physics And Measurement Of Nuclear Radiations (3 semester hours) Interaction of nuclear radiation with matter; electromagnetic interaction of electrons and photons; nuclear interactions. Operation and construction of counters and particle track detectors; electronic data acquisition and analysis systems. Statistical evaluation of experimental data. (3-0) T

PHYS 6349 Special Topics In High Energy Physics (3 semester hours) Topics vary from semester to semester. (May be repeated for credit to a maximum of 9 hours.) (3-0) R

PHYS 6353 Atomic And Molecular Processes (3 semester hours) Study of theory and experimental methods applied to elastic scattering, excitation and ionization of atoms and molecules by electron and ion impact, electron attachment and detachment, and charge transfer processes. (3-0) R

PHYS 6366 Optics of Photonic Band Gap Nanostructures (3 semester hours) Optical properties of periodic dielectric and metallic structures. Basics of photonic band gap (PBG) formation. Critical contrast for complete PBG. Density of states in PBG systems. Intragap states and light localisation phenomena. Tunable PBG: solvatochromism, PBG electro-tuning by liquid crystals. PBG in dispersive media:Bragg-polaritons Plasmon gaps in metallic photonic crystals. Examples of 3-d PBG systems: inverted opals, Si-PBG chips. Inhibition of spontaneous emission in PBG. Low threshold PBG-lasing in “Left-handed” electromagnetic structures with negative refraction. (3-0) R

PHYS 6369 Special Topics In Optics (3 semester hours) Topics vary from semester to semester. (May be repeated for credit to a maximum of 9 hours.) (3-0) R

PHYS 6371 (MSEN 6371) Advanced Solid State Physics (3 semester hours) Continuation of PHYS 5371, transport properties of semiconductors, ferroelectricity and structural phase transitions, magnetism, superconductivity, quantum devices, surfaces. Prerequisite: PHYS 5371 or equivalent. (3-0) R.

PHYS 6372 Physical Materials Science (3 semester hours) Advanced concepts of Materials Science. New directions in fabrication routes and materials design, such as biologically-inspired routes to electronic materials. Advanced materials and device characterization . Prerequisite: PHYS 5376 or equivalent. (3-0) R

PHYS 6374 (MSEN 6374) Optical Properties Of Solids (3 semester hours) Optical response in solids and its applications. Lorentz, Drude and quantum mechanical models for dielectric response function. Kramers-Kronig transformation and sum rules considered. Basic properties related to band structure effects, excitons and other excitations. Experimental techniques including reflectance, absorption, modulated reflectance, Raman scattering. Prerequisite: PHYS 5371 or equivalent. (3-0) T.

PHYS 6376 Electronics and Photonics of Molecular and Organic Solids (3 semester hours) Electronic energy bands in molecular solids and conjugated polymers. Elementary excitations: Frenkel, Wannier and charge transfer excitons. Polarons, bipolarons and solitons. Mobility of excitons and charge carriers, photoconductivity. Charge generation and recombination, electroluminescense, photovoltaic phenomena. Spin selective magnetic effects on excitons and carriers. Superconductivity: granular SC, and field induced SC in organic FETs. (3-0) R

PHYS 6377 (MSEN 6377) Physics of Nanostructures: Carbon nanotubes, Fullerenes, Quantum wells, dots and wires (3 semester hours) Electronic bands in low dimensions. 0-d systems: fullerenes and quantum dots. Optical properties, superconductivity and ferromagnetism of fullerides. 1-d systems: nano-wires and carbon nanotubes (CNT). Energy bands of CNTs: chirality and electronic spectrum. Metallic versus semiconducting CNT: arm-chair, zigzag and chiral tubes. Electrical conductivity and superconductivity of CNTs, thermopower. Electromechanics of SWCNT: artificial muscles. Quantum wells, FETs and organic superlattices: confinement of electrons and excitons. Integer and fractional quantum Hall effect (QHE). (3-0) R.

PHYS 6379 (EE 7V82) Special Topics In Solid State Physics (3 semester hours) Topics vary from semester to semester. (May be repeated for credit to a maximum of 9 hours.) (3-0) R

PHYS 6383 (EE 6383) Plasma Science (3 semester hours): Theoretically oriented study of plasmas. Topics to include: fundamental properties of plasmas, fundamental equations (kinetic and fluid theory, electromagnetic waves, plasma waves, plasma sheaths) plasma chemistry and plasma diagnostics. Prerequisite: PHYS 5421 or equivalent. (3-0) T

PHYS 6385 Atmospheres and Ionospheres (3 semester hours) Characteristics of the neutral upper atmospheres of the earth and planets; including dynamics and structure. Topics include: photochemistry; tides, winds and waves; eddy and molecular diffusion; and magnetospheric energy inputs. Prerequisite: PHYS 5381. (3-0) R

PHYS 6388 Ionospheric Electrodynamics (3 semester hours) Generation of electric fields in the earth’s ionosphere. The role of internal dynamos and external generators from the interaction of the earth with the solar wind. Satellite and ground-based observations of ionospheric phenomena such as ExB drift, the polar wind and plasma instabilities. Prerequisites: PHYS 5421, PHYS 6383 (3-0) R

PHYS 6V59 Special Topics In Atomic Physics (1-3 semester hours) Topics vary from semester to semester. (May be repeated for credit to a maximum of 9 hours.) ([1-3]-0) R

PHYS 6389 Special Topics In Space Physics (3 semester hours) Topics will vary from semester to semester. (May be repeated for credit to a maximum of 9 hours.) (3-0) R

PHYS 6399 Special Topics In Relativity (3 semester hours) Topics vary from semester to semester. (May be repeated for credit to a maximum of 9 hours.) (3-0) R

PHYS 7V10 Internal Research (3-6 Semester Hours) On campus research for Masters in Applied Physics. May be repeated for credit. ([3-6]-0) S

PHYS 7V20 Industrial Research (3-6 Semester Hours) Industrial research for Masters in Applied Physics. May be repeated for credit. ([3-6]-0) S

PHYS 7171 (EE 7171) Current Topics in Plasma Physics (1 semester hour):

Discussion of current literature on plasma processing and general plasma physics; applications, diagnostics, sources, chemistry and technology. (May be repeated up to three times for credit.) Prerequisite or co-requisite: PHYS 6383.(1-0) S

PHYS 8V10 Research In High Energy Physics And Elementary Particles (3-9 semester hours) (P/F grading) (May be repeated for credit.) ([3-9]-0) S

PHYS 8V20 Research in Cosmology and Astrophysics (3-9 semester hours) (P/F grading) (May be repeated for credit) ([3-9]-0) S

PHYS 8V30 Research In Quantum Electronics (3-9 semester hours) (P/F grading) (May be repeated for credit.) ([3-9]-0) S

PHYS 8V50 Research In Atomic And Molecular Physics (3-9 semester hours) (P/F grading) (May be repeated for credit.) ([3-9]-0) S

PHYS 8V60 Research In Optics (3-9 semester hours) (P/F grading) (May be repeated for credit.) ([3-9]-0) S

PHYS 8V70 Research In Materials Science (3-9 semester hours) (P/F grading) (May be repeated for credit.) ([3-9]-0) S

PHYS 8V80 Research In Atmospheric And Space Physics (3-9 semester hours) (P/F grading) (May be repeated for credit.) ([3-9]-0) S

PHYS 8V90 Research In Relativity (3-9 semester hours) (P/F grading) (May be repeated for credit.) ([3-9]-0) S

PHYS 8398 Thesis (3 semester hours) (May be repeated for credit.) (3-0) R

PHYS 8399 Dissertation (3 semester hours) (May be repeated for credit.) (3-0) S