PHYSICS (PHYS)

PHYS 507 INTRO MATH PHYS (3)

As the mathematical maturity of the students will allow, selected topics will be examined such as the generalized expressions for forces and potentials, vector analysis, applications of Fourier series and complex variables, and solutions of the harmonic oscillator and wave equations. Three lecture hours. Prerequisites: PHYS 212 or PHYS 242; MATH 274.

PHYS 511 MODERN PHYSICS (3)

Special relativity, the quantum theory, atomic structure and spectra, and nuclear structure and reactions are the main topics covered by the course. Other topics that may be covered involve molecular, solid state, and high energy physics. Four lecture hours. Prerequisites: MATH 274; PHYS 212 or PHYS 242.

PHYS 512 MODERN PHYSICS II (3)

Co-listed with PHYS 312 which is a required course for the Applied and General tracks of the Physics major. Application of special Relativity and Quantum theory to the various disciplines in physics including solid state physics, nuclear physics, elementary particles and cosmology. Students taking this course for graduate credits will be expected to attend special lectures and seminars, undertake guided in-depth study of selected topics and complete additional assigments which may include presentations and term papers. Prerequisite: PHYS 311 or consent of instructor.

PHYS 533 BASIC ELECTRONICS (4)

Circuit components, characteristics of semiconductors, electrical measurements, method of circuit analysis, electronic devices. Three lecture hours and one three-hour laboratory. Prerequisite: PHYS 212 or PHYS 222 or consent of instructor.

PHYS 534 DIGITAL ELECTRONICS (4)

Subjects covered will be basic concepts of digital electronics such as: gates, logic modules, truth tables, digital codes, sequential systems, semiconductor memories, decade counters, etc. The laboratory program is designed to give students firsthand experience on the material covered in lecture using integrated circuits and LED display systems. Two hours lecture and three hours laboratory. Prerequisite: MATH 115 or equivalent.

PHYS 535 ELECTRONICS (3)

Principles of transistors with emphasis on their design and construction and an introduction to logic circuits. Two lecture hours and one two-hour laboratory. Prerequisites: PHYS 305 and PHYS 335.

PHYS 537 INTRODUCTION TO MICROPROCESSOR BASED DIGITAL SYSTEMS (3)

Introductory course on basic microcomputer concepts. Topics covered include basic structure and organization of microcomputers, digital logic design, assembly language programming, memory elements and applications. Hardware-oriented experiments will be conducted providing practical experience in interfacing the microcomputer to a variety of instruments and input-output devices. Two hours lecture and two hours laboratory. Prerequisite: PHYS 337.

PHYS 541 INTERMEDIATE PHYSICS LABORATORY I (3)

First semester: the measurement of several fundamental physical constants. Exploration of classical and modern research methods: lasers, holography, optical and nuclear spectroscopy. Second semester: several advanced experiments and a research project. Familiarization with machine shop procedure, vacuum and other experimental techniques. Five laboratory hours. Prerequisite: PHYS 311 (may be taken concurrently).

PHYS 542 INTERMEDIATE PHYSICS LABORATORY II (3)

First semester: the measurement of several fundamental physical constants. Exploration of classical and modern research methods: lasers, holography, optical and nuclear spectroscopy. Second semester: several advanced experiments and a research project. Familiarization with machine shop procedure, vacuum and other experimental techniques. Five laboratory hours. Prerequisite: PHYS 341.

PHYS 550 MECHANICS (4)

Systems of coordinates, kinematics and transformations; newtonial dynamics of particles; linear systems, oscillations and series techniques; calculus of variations and the Lagrangian and Hamiltonian formulations; application of Lagrangians to gravitation/central force motion. Optional; nonlinear oscillations. Prerequisite: PHYS 242, PHYS 307 or consent of instructor.

PHYS 551 MECHANICS II (3)

Continuation of PHYS 351. Rotation transformations; perturbation and Green's function techniques in solution of oscillating systems; collisions; rotating frames of reference and dynamics of rigid bodies (including Euler's angles, precession, notation); theory of coupled small oscillations. Optional; special relativity; continuum mechanics. Prerequisite: PHYS 351.

PHYS 552 THERMODYNAMICS AND KINETIC THEORY (3)

Principles and laws of classical thermodynamics applied to simple irreversible processes, including chemical, elastic, electric and magnetic phenomena; thermodynamic functions and Maxwell's relations; the conservation equations in elementary kinetic theory; fluctuations and irreversible transfer effects. Three lecture hours. Prerequisites: PHYS 212 or PHYS 243, MATH 274 (may be taken concurrently with PHYS 243 or by permission).

PHYS 553 PHYSICAL OPTICS (3)

Electromagnetic theory of light, wave solutions, interference, diffraction, scattering, radiation from coherent and incoherent sources, elementary theory of masers and lasers. Three lecture hours. Prerequisite: PHYS 354 or consent of instructor.

PHYS 554 ELECTRICITY AND MAGNETISM (4)

Electrostatics, magnetostatics and electromagnetic radiation, including Divergence Theorem and Stoke's Theorem, electrostatics in free space and dielectric materials, the Biot-Savart Law, the magnetic vector potential, inductance and electromotance, magnetic materials, Maxwell's equations in free space and in materials, boundary value problems (Snell's and Fresnel's Laws). Prerequisite: PHYS 243, PHYS 307 or consent of instructor.

PHYS 555 INTRODUCTORY QUANTUM MECHANICS (3)

The Schroedinger equation, states of one particle in one dimension, potential barrier problems in one dimension, the harmonic oscillator, system of particles in one dimension, motion in three dimensions, angular momentum, spin, application to atomic physics. Prerequisites: PHYS 311, PHYS 351 (may be taken concurrently).

PHYS 556 INTRODUCTION TO STATISTICAL MECHANICS (3)

Distribution functions, microcanonical, canonical and grand canonical ensembles, the partition function and thermodynamics relations. Fermi-Dirac and Bose-Einstein statistics, some simple models and applications, the Maxwell-Botzman transport equation and the hydrodynamic equation, transport coefficients. Three lecture hours. Prerequisite: PHYS.

PHYS 557 SOLID STATE PHYSICS (3)

Crystal structure, wave propagation in periodic structures, the Fermi gas, energy bands, magnetism are present as a central theoretical core for the study of the solid state. Some of the basic models, concepts and manifest properties of solids are also included. Prerequisites: PHYS 311, PHYS 351, and PHYS 354.

PHYS 559 NUCLEAR PHYSICS (3)

A lecture and problem course dealing on an introductory level concerning experimental and theoretical method for the study of nuclear structure. Topics to be covered include: properties of nuclei, electromagnetic transition and beta decay; nuclear models, nuclear reactions and two-body interactions.

PHYS 561 OPTICS FUNDAMENTALS (4)

Develops the fundamental concepts relating to geometric optics, wave optics, and quantum optics and provides exposition to selected advanced topics emphasizing practical applications of optical techniques, measurements, design, and instrumentation. Instructional topics include lenses and mirrors, lens aberrations and design, optical instruments, interference, diffraction, polarization, absorption and scattering, lasers, holography and the dual nature of light. Prerequisites: PHYS 243 and PHYS 341 or consent of the instructor.

PHYS 570 SPECIAL TOPICS IN PHYSICS (1-4)

Special topics in the area of physics. Special topics will be determined by current interests of the faculty and the needs of the curriculum. Prerequisite: department consent.

PHYS 585 PHYS SEMINAR I (1)

Students participate in colloquia on topics of current interest in physics research under guidance instructor. One lecture hour. Prerequisite: Senior standing or consent of instructor.

PHYS 590 INDEPENDENT STUDY IN PHYSICS (1-4)

Prerequisites: At least junior status and one course in the physics department; may be repeated for a maximum of 6 credits.

PHYS 591 DIRECTED READINGS (1-4)

Prerequisite: At least junior status and one course in the physics department; may be repeated for a maximum of 6 credits.

PHYS 595 RESEARCH PROBLEMS IN PHYSICS (1-3)

Individual project in any branch of physics. Students can choose either to work on projects or in areas suggested by physics faculty. At the completion of a project, the student must write a formal research paper on the work done. Students may register for this more than once but at different levels. Prerequisite: Permission of the instructor who will direct the proposed work.

PHYS 596 RESEARCH PROBLEMS IN PHYSICS (1-3)

Individual project in any branch of physics. Students can choose either to work on projects or in areas suggested by physics faculty. At the completion of a project, the student must write a formal research paper on the work done. Students may register for this more than once but at different levels. Prerequisite: Permission of the instructor who will direct the proposed work.

PHYS 641 LABORATORY TECHNIQUES AND INSTRUMENTATION (3)

An introduction to experimental methods of fabrication and characterization of advanced materials and devices including analytical techniques and instrumentation employed in applied research and in industry; computer-based data acquisition and experimental control, materials fabrication and characterization, cryogenic and vacuum techniques.

PHYS 652 HIGH ENERGY ASTROPHYSICS (0)

An in-depth introduction to the physics of high energy phenomena in the universe at the graduate level, including emission from white dwarfs, neutron stars/black holes, supernova explosions/supernova remnants, active galactic nuclei and galaxy clusters. Introduction to high energy radiation from these phenomena, including X-ray absorption, synchrotron radiation, bremsstrahlung radiation and gamma-ray emission. Prerequisite: instructor consent.

PHYS 658 MAGNETISM AND MAGNETIC MATERIALS (3)

Fundamental principles of magnetism as well as techniques and applications based on these principles. Isolated magnetic moments, exchange interaction, magnetic ordering and magnetic structures, magnetic resonance techniques, phase transitions, magnetic excitations, magnetoresistance, spin electronics.

PHYS 662 SPECTROSCOPIC AND MICROSCOPIC TECHNIQUES (3)

An introduction to modern spectroscopic and microscopic techniques employed in the measurement of novel nanoscale and condensed matter materials. Techniques include absorption, Fourier-transform, Raman, and fluorescence spectroscopies; near-field microscopies; atomic force microscopies; scanning tunneling and transmission electron microscopies/spectroscopies. Three lecture hours.

PHYS 663 FUNCTIONAL ELECTRONIC MATERIALS (3)

This course provides advanced, state of the art knowledge of functional electronic materials employed in current and emerging technologies, including metals, dielectrics, semiconductors, superconductors and magnetic materials. Topics of emphasis will include electronic phenomena that underlie technological applications, structure property correlations and opportunities and challenges associated with engineering the material properties in thin film/nanoscale structures for device applications.

PHYS 664 NANOTECHNOLOGY (3)

An introduction to structures and processes which occur at the nanometer length scale. Topics include properties of nanostructures, nanofabrication, and nanomechanics.

PHYS 670 COMPUTATIONAL PHYSICS (3)

The use of computational techniques in the study of applied physics. The emphasis is on the modeling and analysis of physical systems as applied to physics and astronomy, and on the analysis of experimental data. Topics covered include error analysis, analysis of oscillatory and periodic motions, waveforms, advanced curve fitting techniques, spectral analysis, systems of equations, diffusion equation, Schrodinger Equation, finite element analysis, molecular dynamics simulation, Metropolis algorithm and Monte Carlo simulations. Two hours lecture and one hour laboratory.

PHYS 680 SPECIAL TOPICS IN PHYSICS (1-4)

Special topics in the area of physics. Special topics will be determined by current interests of the faculty and the needs of the curriculum. May be repeated for a maximum of 9 units. Prerequisite: department consent.

PHYS 685 PROFESSIONAL SCIENCE MASTERS SEMINAR (1)

Guest speakers from industry, government agencies, national laboratories and non-profit organizations will share various aspects of their professional environments. The seminar course will offer students opportunities to network with potential employers and also serve as a forum for sharing internship projects and experience with faculty and peers. Course is S/U grading.

PHYS 690 INDEPENDENT STUDY (3)

Independent study of a topic in one of the sub-disciplines of physics. The study will be commensurate with the breadth and depth expected at the Master's level. Prerequisite: consent of department.

PHYS 795 APPLIED PHYSICS RESEARCH (3)

Students will undertake research in applied physics under the guidance of a faculty member on research topics that have a strong relevance to technological application in the work place. Whenever possible, these topics have a strong relevance to technological application in the work place. Whenever possible, these topics will be chosen to allow the student to be involved in faculty collaborations with industry or other technology work places. May be repeated for a maximum of 9 units.

PHYS 799 PHYSICS MASTER'S INTERNSHIP (1-9)

Students will gain practical experience by working onsite at an industry, government or nonprofit agency organization in an internship position. May be repeated for a maximum of 18 units. S/U Grading.

PHYS 896 MASTER'S RESEARCH PROJECT (1-6)

Students will carry out a research project under the supervision of a faculty advisor, in physics, astronomy or an interdisciplinary area in related disciplines. Prior to enrolling in the course, the student and the faculty advisor will decide on a topic of mutual interest and agree upon the expectations for successful completion. The student will submit a pre-proposal including a broad outline of the proposed research and the expectations for successful completion that were agreed upon. Signed approval of the pre-proposal by the faculty advisor and the graduate program director are required before enrollment. Course requirements include research work for a minimum of three hours of research weekly per credit unit. Successful completion of the research project includes completion of a Research Portfolio, a copy of which must be submitted to department. The research portfolio must include, at a minimum, two or more products from among the following (i) An abstract submitted/accepted to a national/international conference (ii) An oral or poster presentation at a research conference (iii) A project report (iv) A manuscript for a peer reviewed journal (v) A seminar presented by the student. Students may also include other items related to the project as appropriate. Graded S/U. Prerequisites: consent of department; completion of PHYS 795 and pre-proposal with signed approval by the faculty advisor and the graduate program director are required prior to enrollment.

PHYS 897 PHYSICS THESIS (6)

Students will undertake research in applied physics towards a masters thesis under the guidance of a faculty member. Thesis research will be structured so that student swill need to collaborate actively and function as a team. Research topics will be chosen that have a strong relevance to technological application in the work place. Whenever possible, these topics will be chosen to allow the student to be involved in faculty collaborations with industry or other technology work places. Prerequisite: PHYS 795.

PHYS 898 PHYSICS THESIS (3)

Students will undertake research in applied physics towards a masters thesis under the guidance of a faculty member. Thesis research will be structured so that student swill need to collaborate actively and function as a team. Research topics will be chosen that have a strong relevance to technological application in the work place. Whenever possible, these topics will be chosen to allow the student to be involved in faculty collaborations with industry or other technology work places. Taken over two semesters for a total of 6 units. Prerequisite: PHYS 795.

PHYS 899 THESIS CONTINUUM (1)

Continuation of thesis research.