Physics (PHYS)

COURSES

PHYS 1181. PROBLEMS IN MECHANICS. 1 Hour.
Primarily an independent study course involving problem-solving in general technical mechanics. The objective is to prepare the student whose background in physics is of a non-technical nature to do advanced study in curricula requiring technical physics. This course in combination with PHYS 1441 shall serve as an equivalent to PHYS 1443. Prerequisite: MATH 1426 and a grade of B or better in PHYS 1441. Department consent may be granted to take this course with Physics B AP score of 4 or 5.

PHYS 1182. PROBLEMS IN ELECTRICITY AND MAGNETISM. 1 Hour.
Primarily an independent study course involving problem-solving in general technical electricity and magnetism. The objective is to prepare the student whose background in physics is of a non-technical nature to do advanced study in curricula requiring technical physics. This course in combination with PHYS 1442 shall serve as an equivalent to PHYS 1444. Prerequisite: MATH 2425 and a grade of B or better in PHYS 1442. Department consent may be granted to take this course with Physics B AP score of 4 or 5.

PHYS 1188. SPECIAL PROBLEMS IN GENERAL PHYSICS. 1 Hour.
Primarily laboratory work and/or problem-solving in general technical physics. Prerequisite: PHYS 1441 or PHYS 1443 lecture credit equivalent or PHYS 1442 or PHYS 1444 lecture credit equivalent.

PHYS 1288. SPECIAL PROBLEMS IN GENERAL PHYSICS. 2 Hours.
Primarily laboratory work and/or problem-solving in general technical physics. Prerequisite: PHYS 1441 and PHYS 1442 lecture credit equivalent or PHYS 1443 and PHYS 1444 lecture credit equivalent.

PHYS 1300. INTRODUCTION TO MUSICAL ACOUSTICS. 3 Hours.
An introduction, for the music major, to the nature of periodic motion and its relation to music, characteristics of sound waves, sources of sound used in music, musical scales and temperament, mechanics of hearing, recording and reproduction of sound. May not be used to satisfy any of the requirements for a degree in physics.

PHYS 1301. PHYSICS FOR NON SPECIALISTS I. 3 Hours.
PHYS 1301 and 1302 constitute a one-year introductory course for liberal arts and business majors. How physics plays a role in everyday life; explanations of how things work. Helps develop analytical thinking. The first semester explains motion and forces and heat.

PHYS 1302. PHYSICS FOR NON SPECIALISTS II. 3 Hours.
Follows PHYS 1301 and explains sound, light, electricity and magnetism. Prerequisite: PHYS 1301 or permission from instructor.

PHYS 1351. ENERGY AND ENVIRONMENT. 3 Hours.
This course explores the fundamental laws of nature and natural processes related to energy production, transport, storage, and uses. The objective of this course is to provide students with an in-depth understanding of the Physics of Energy and its relation to the Earth Environment. The course is designed for non-science major students with two one-hour lectures (or one two-hour lecture) and one 2-hour laboratory per week.

PHYS 1441. GENERAL COLLEGE PHYSICS I. 4 Hours. (TCCN = PHYS 1401)
The first half of a one-year, non-calculus introductory physics course taken by pre-medical, pre-dental, biology and architectural majors and others. The study of mechanics, elasticity, fluids, heat and waves is supplemented by laboratory experiments. Familiarity with high school algebra and trigonometry is required.

PHYS 1442. GENERAL COLLEGE PHYSICS II. 4 Hours. (TCCN = PHYS 1402)
The second half of a one-year, non-calculus introductory physics course. Subject matter includes electricity and magnetism, light and optics, and modern physics. Prerequisite: PHYS 1441 or equivalent, or permission of instructor.

PHYS 1443. GENERAL TECHNICAL PHYSICS I. 4 Hours. (TCCN = PHYS 2425)
The first half of a one-year technical course. Required for many science and engineering majors, exceeds premedical requirement. The study of physical phenomena in the fields of mechanics, heat, and waves. Concurrent enrollment in MATH 1426 (per prerequisite) is not recommended if no prior background in calculus. Prerequisite: MATH 1426 or consent of instructor.

PHYS 1444. GENERAL TECHNICAL PHYSICS II. 4 Hours. (TCCN = PHYS 2426)
The second half of a one-year technical course. The study of physical phenomena including electricity, magnetism, circuit theory, light, and optics. Prerequisites: PHYS 1443 or equivalent and MATH 2425 or concurrent enrollment.

PHYS 2311. MATHEMATICAL METHODS OF PHYSICS. 3 Hours.
Harmonic oscillators, waves, vector description of particles and fields, coordinate transformations, eigenvalue problems, and systems of linear equations. Prerequisites: PHYS 1444 or equivalent and MATH 2425.

PHYS 2315. INTRODUCTORY ASTROPHYSICS. 3 Hours.
This course introduces Science and Engineering majors to astrophysics. Subject matter includes the solar system, stellar properties and evolution, the Milky Way galaxy, normal and active galaxies, and cosmology. Prerequisite: PHYS 1444 or permission of the instructor.

PHYS 2321. COMPUTATIONAL PHYSICS. 3 Hours.
Development of computational techniques, including simulation, through applications to physical problems. A survey of topics including the multi-body problem, celestial mechanics, scattering, chaos, percolation, fractals, random processes, Fourier techniques in wave phenomena, Monte Carlo methods, and image reconstruction techniques. Prerequisite: PHYS 1444 or equivalent.

PHYS 3183. MODERN PHYSICS LABORATORY. 1 Hour.
Supplements the topics covered in PHYS 3313. Prerequisite: PHYS 3313 or concurrent enrollment.

PHYS 3313. INTRODUCTION TO MODERN PHYSICS. 3 Hours.
A brief introduction to the theories of quantum mechanics and statistical mechanics followed by a survey of atomic physics, conductors, semiconductors and modern electronic devices, nuclear and sub-nuclear physics. Prerequisites: PHYS 1444 or equivalent and MATH 2425.

PHYS 3315. ASTROPHYSICS AND COSMOLOGY. 3 Hours.
Diverse concepts in theoretical physics are applied to a wide range of astrophysical problems. Topics include stellar properties, spectra, evolution, radiation transport, nuclear reactions, degenerate matter, orbital mechanics, galactic dynamics, introductory general relativity and cosmology. Prerequisite: PHYS 3313 and MATH 3318 or MATH 3319.

PHYS 3316. ASTROBIOLOGY I. 3 Hours.
This is an interdisciplinary course between astrophysics, biology and geology. Topics include properties of life, origin and evolution of life on Earth, terrestrial geology and habitability, environmental forcings, extremophiles, mass extinctions, meteorites, searches for life in the solar system. Offered as BIOL 3316, GEOL 3316 and PHYS 3316; credit will be granted only once. Prerequisite: PHYS 1441 & PHYS 1442 or equivalent and PHYS 2315 or PHYS 3315, or permission from instructor. Prerequisites for Biology majors: PHYS 1441 & PHYS 1442 or equivalent.

PHYS 3321. INTERMEDIATE ELECTRICITY AND MAGNETISM. 3 Hours.
Vector algebra and vector calculus applied to electrostatics, magnetostatics, the study of dielectric materials, and boundary value problems. Prerequisite: PHYS 2311 and MATH 3318 or MATH 3319.

PHYS 3341. INTRODUCTION TO BIOLOGICAL PHYSICS. 3 Hours.
This course will cover four parts: Part I - History of Biological Physics and the general introduction of Cell biology; Part II - Physics of Biomaterials including polymer Physics; DNA & RNA; Protein Structures, Functions and Physics; Part III - Physics of life genetics including molecular motors, ATP functions, Photosynthesis and Physics of genetic regulations; and Part IV - Physics of biological detection including Physics of Radiation diagnosis; Optical Imaging; Magnetic Resonance Imaging and Ultrasound imaging. Prerequisite: PHYS 1442 or PHYS 1444 or equivalent.

PHYS 3342. INTRODUCTION TO NANO-BIO PHYSICS. 3 Hours.
The objective of this course is to provide students with an in-depth understanding of the physics of nanotechnology and its biological applications. The course is composed of two parts: nanoparticle physics and nano-bio physics. In the first part, the physics of nanotechnology will be introduced. The second part is the biological applications of nanotechnology, for which the focus will be on how to understand the physics of these applications. The understanding of the physical objectives for these applications will be helpful for the exploration of nano-biotechnology. Key advances from the recent literature will be reviewed and introduced to students as supplemental topics. Prerequisite: PHYS 1442 or PHYS 1444 or equivalent.

PHYS 3358. ASTROBIOLOGY II. 3 Hours.
This is an interdisciplinary course between astrophysics, biology and geology. Topics include basic properties of life, habitability of Earth, studies of possible life regarding Mars, Europa & Titan, space missions, exoplanets and exomoons, stellar habitable zones, multistellar systems, exoEarths, biomarkers, SETI, Fermi paradox, Drake equation, cosmology. Offered as BIOL 3358, GEOL 3358, and PHYS 3358; credit will be granted only once. Prerequisite: PHYS 1441 & PHYS 1442 or equivalent and PHYS 2315 or PHYS 3315, or permission from instructor. Prerequisites for Biology majors: PHYS 1441 & PHYS 1442 or equivalent. Note that Astrobiology I is strongly recommended to students to be taken prior to Astrobiology II, but is not a prerequisite.

PHYS 3360. PHYSICS OF THE HUMAN BODY. 3 Hours.
This course will explore the fundamental laws and natural processes related to the mechanics, fluid dynamics, optics, and biophysics of the human body. It is designed for kinesiology pre-health, biology and nursing students seeking to understand the foundations and biophysical principles of human life. Note that Kinesiology students seeking to apply to science based graduate programs are advised to take PHYS 1441 and PHYS 1442 so the prerequisite requirement of these courses will not preclude the students for whom PHYS 3360 is intended from taking the course. Prerequisite: PHYS 1441.

PHYS 3366. SPECIAL TOPICS IN PRE-COLLEGE PHYSICAL SCIENCE INSTRUCTION. 3 Hours.
A laboratory oriented curriculum for teaching physical science and/or physics is developed and experienced. The developed curriculum is particularly appropriate for pre-college instruction. May be repeated for credit as the subject matter changes, but not more than six hours credit may be accumulated. Prerequisite: junior standing, six hours of science, three hours of education, and consent of the instructor.

PHYS 3445. OPTICS. 4 Hours.
Fundamental principles of physical and geometric optics, absorption and scattering, Planck's quantum theory of radiation, diffraction, interference, light sources, and spectra. Prerequisites: PHYS 1444 or equivalent and MATH 2425.

PHYS 3446. NUCLEAR AND PARTICLE PHYSICS. 4 Hours.
The study of atomic nuclei and the fundamental constituents of matter. Topics include nuclear structure, radioactivity, nuclear reactions, fission, fusion, particles and their interactions, the standard model of particle physics, experimental methods, accelerators, and examples from current research topics. Prerequisite: PHYS 3313.

PHYS 3455. ELECTRONICS. 4 Hours.
A study of electronic components and quantum devices and their application to circuits and instrumentation. Prerequisites: PHYS 3313 and MATH 2425.

PHYS 4081. UNDERGRADUATE RESEARCH IN PHYSICS. 0 Hours.
Independent research conducted on a selected topic under the supervision of a member of the Physics faculty. This course may be repeated. This is a non-credit course so cannot be used to meet degree requirements. Prerequisite: Permission of instructor.

PHYS 4117. INDIVIDUAL LEARNING BY SEMINAR. 1 Hour.
Individual instruction on using the seminar as a model of learning current topics in physics. An individual report is required. Prerequisite: 18 hours of physics and senior standing.

PHYS 4171. ADVANCED OPTICS LABORATORY. 1 Hour.
Special laboratory projects in advanced optics. Prerequisite: PHYS 3445 or permission of the instructor.

PHYS 4181. SPECIAL PROBLEMS. 1 Hour.
Selected projects in research or teaching laboratories, which may be repeated in any order for a total credit not to exceed four hours, unless authorized by the undergraduate advisor. Prerequisite: Permission from instructor and Physics undergraduate advisor.

PHYS 4185. ADVANCED ELECTRICITY AND MAGNETISM LABORATORY. 1 Hour.
Supplements the topics covered in PHYS 3321 and PHYS 4324. Prerequisite: PHYS 4324 or concurrent enrollment.

PHYS 4191. SPECIAL TOPICS IN PHYSICS. 1 Hour.
Selected topics arranged on an individual basis, which may be repeated with permission from instructor and Physics undergraduate advisor. Prerequisite: as determined for topic or permission from instructor.

PHYS 4271. ADVANCED OPTICS LAB. 2 Hours.
Special laboratory projects in advanced optics. Prerequisite: PHYS 3445 or permission of the instructor.

PHYS 4281. SPECIAL PROBLEMS. 2 Hours.
Selected projects in research or teaching laboratories, which may be repeated in any order for a total credit not to exceed four hours, unless authorized by the undergraduate advisor. Prerequisite: permission from the instructor and the Physics undergraduate advisor.

PHYS 4291. SPECIAL TOPICS. 2 Hours.
Selected topics arranged on an individual basis, which may be repeated with permission from instructor and Physics undergraduate advisor. Prerequisite: as determined for topic or permission from instructor.

PHYS 4315. THERMODYNAMICS AND STATISTICAL MECHANICS. 3 Hours.
Topics in classical thermodynamics include the laws of thermodynamics, Gibbs' and Helmholtz's free energies, the Maxwell relations, heat capacities, entropy change calculations, phase and chemical changes. Statistical mechanics centers on the partition function and its applications, such as the entropy of an ideal gas, the Maxwell velocity distribution, the heat capacity of a solid, photon statistics, and blackbody radiation. Fermi-Dirac and Bose-Einstein statistics. Prerequisite: PHYS 3313 and MATH 2326 or permission of the instructor.

PHYS 4319. ADVANCED MECHANICS. 3 Hours.
Coupled oscillators, central forces, Lagrange's equations, Hamilton's canonical equations, the moment of inertia tensor, and the application of Euler's angles to rotational motion. Prerequisite: PHYS 2311, PHYS 3321, and MATH 3318 or MATH 3319, or permission of the instructor.

PHYS 4324. ADVANCED ELECTRICITY AND MAGNETISM. 3 Hours.
Electromagnetic phenomena based on Maxwell's equations and particle-field interactions. Prerequisite: PHYS 3321 or permission of the instructor.

PHYS 4325. SOLID STATE PHYSICS. 3 Hours.
Classification of crystalline solids and elastic and thermal properties, electric and magnetic properties, and electronic properties of solids. An introduction to current research problems. Prerequisite: PHYS 4315 or permission of the instructor.

PHYS 4326. INTRODUCTION TO QUANTUM MECHANICS. 3 Hours.
Schrodinger equation and implications, the free particle, the one-electron atom, the potential barrier, and perturbation theory. Prerequisite: PHYS 3313, MATH 3318 or MATH 3319, or permission of the instructor.

PHYS 4327. INTRODUCTION TO QUANTUM MECHANICS II. 3 Hours.
This is a continuation of Introduction to Quantum Mechanics (PHYS 4326). The topics that will be covered will include: time-independent perturbation theory for non-degenerate states, degenerate perturbation theory, atoms with one or two electrons and molecules, Fermi and Bose gases, time-dependent perturbation theory, scattering theory, and introduction to relativistic quantum mechanics. Prerequisite: PHYS 4326 or permission from instructor.

PHYS 4343. RESEARCH METHODS - UTEACH. 3 Hours.
The purpose of this course is to present UTeach students with the tools scientists use to solve scientific problems. These tools enable scientists to develop new knowledge and insights, the most important of which are eventually presented in textbooks and taught in more conventional science classes. These tools include: design of experiments to answer scientific questions; use of statistics to interpret experimental results and deal with sampling errors; mathematical modeling of scientific phenomena; finding and reading articles in the current scientific literature; applying scientific arguments in matters of social importance; writing scientific papers; reviewing scientific papers; oral presentation of scientific work; use of probes and computers to gather and analyze data; ethical treatment of human subjects; laboratory safety. Research Methods is primarily a laboratory course, and most of these topics are developed in connection with 4 independent inquiries UTeach students design and carry out. Written inquiries will be evaluated as examples of scientific writing. Prerequisite: C or better in SCIE 1201 or SCIE 1334 or concurrent enrollment; junior or senior standing.

PHYS 4391. SPECIAL TOPICS. 3 Hours.
Selected topics arranged on an individual basis, which may be repeated with permission from instructor and Physics undergraduate advisor. Prerequisite: as determined for topic or permission from instructor.

PHYS 4393. HONORS THESIS IN PHYSICS. 3 Hours.
Required of all students in the University Honors College. During the senior year the honors physics major will perform a research project under the direction of a Physics Department faculty member.

PHYS 5193. READINGS IN PHYSICS. 1 Hour.
Conference course. May be repeated for credit.

PHYS 5194. RESEARCH IN PHYSICS. 1 Hour.
Conference course with laboratory. May be repeated for credit.

PHYS 5294. RESEARCH IN PHYSICS. 2 Hours.
Conference course with laboratory. May be repeated for credit.

PHYS 5305. CHAOS AND NONLINEAR DYNAMICS. 3 Hours.
Introduction to basic principles and concepts of chaos theory and their applications in diverse fields of research. Topics include chaotic and non-chaotic systems, stability analysis and attractors, bifurcation theory, routes to chaos and universality in chaos, iterated maps, Lyapunov exponents, fractal dimensions, multifractals, hamiltonian chaos, quantum chaos, controlling chaos, self-organized systems, and theory of complexity.

PHYS 5306. CLASSICAL MECHANICS. 3 Hours.
General principles of analytical mechanics, the kinematics of rigid bodies, canonical transformation, Hamilton-Jacobi theory.

PHYS 5307. QUANTUM MECHANICS I. 3 Hours.
Matrix formulation, theory of radiation, angular momentum, perturbation methods.

PHYS 5308. QUANTUM MECHANICS II. 3 Hours.
Approximate methods, symmetry and unitary groups, scattering theory. Prerequisite: PHYS 5307.

PHYS 5309. ELECTROMAGNETIC THEORY I. 3 Hours.
Boundary value problems in electrostatics and magnetostatics, Maxwell's equations.

PHYS 5310. STATISTICAL MECHANICS. 3 Hours.
Fundamental principles of statistical mechanics, Liouville theorem, entropy, Fermi-Dirac distribution, Bose-Einstein distribution, Einstein condensation, density matrix, quantum statistical mechanics, kinetic methods, and transport theory.

PHYS 5311. MATHEMATICAL METHODS IN PHYSICS I. 3 Hours.
Algebraic and analytical methods used in modern physics. Algebra: matrices, groups, and tensors, with application to quantum mechanics, the solid state, and special relativity. Analysis: vector calculus, ordinary and partial differential equations, with applications to electromagnetic and seismic wave propagation.

PHYS 5312. MATHEMATICAL METHODS IN PHYSICS II. 3 Hours.
Continuation of PHYS 5311 with a selection from the following topics. Algebra: matrix representations of the symmetric and point groups of solid state physics, matrix representations of the continuous groups O(3), SU(2), SU(3), SL(2,C), general covariance. Analysis: further study of analytic functions, Cauchy's theorem, Green's function techniques, orthogonal functions, integral equations. Prerequisite: PHYS 5311.

PHYS 5313. ELECTROMAGNETIC THEORY II. 3 Hours.
Modern tensorial treatment of classical electrodynamics, force on and field of a moving charge, derivation and application of 4-vector potential, Maxwell's equations in tensor form, field momentum and radiation. Prerequisite: PHYS 5309.

PHYS 5314. ADVANCED OPTICS. 3 Hours.
Electromagnetic wave equations, theory of diffraction, radiation scattering and dispersion, coherence and laser optics. Additional advanced topics of current interest.

PHYS 5315. SOLID STATE I. 3 Hours.
Crystal structure, lattice vibration, thermal properties, and band theory of solids.

PHYS 5316. SOLID STATE II. 3 Hours.
Electrical and magnetic properties of crystalline solids, magnetic resonance, and optical phenomena. Prerequisite: PHYS 5315.

PHYS 5317. STATISTICAL MECHANICS II. 3 Hours.
Methods in applied statistical mechanics. Topics may include fluctuations and critical phenomena, the Ising model, the master equation, transport in solids, and chaos. Prerequisite: PHYS 5310.

PHYS 5319. MATHEMATICAL METHODS IN PHYSICS III. 3 Hours.
Numerical methods for applied physics; computer techniques, numerical differentiation, integration, interpolation, extrapolation; differential equations, integral equations, statistical analysis; scientific computer library; artificial intelligence programming.

PHYS 5320. QUANTUM MECHANICS III. 3 Hours.
Quantum theory of radiation; relativistic equations; elements of quantum field theory; symmetries and gauge theories. Applications in elementary particle physics and solid-state physics. Prerequisite: PHYS 5308 and PHYS 5312.

PHYS 5325. INTRODUCTION TO ELEMENTARY PARTICLES I. 3 Hours.
An overview of particles and forces. Particle detectors and accelerators. Invariance principles and conservation laws. Standard model. Electromagnetic, weak, strong, and unified interactions.

PHYS 5326. INTRODUCTION TO ELEMENTARY PARTICLE PHYSICS II. 3 Hours.
Systematics of the quark model; the fundamental interactions of elementary particles; spin and relativistic kinematics; Dirac Equation; the standard electroweak model. Prerequisite: PHYS 5325.

PHYS 5328. SURFACE PHYSICS. 3 Hours.
Experimental and theoretical methods for the study of solid surfaces. Geometric and electronic structure of metals and semiconductors. Surfaces as model systems of reduced dimensionality. Adsorption phenomena and film growth.

PHYS 5330. PHYSICS OF SEMICONDUCTOR PROCESSING AND CHARACTERIZATION. 3 Hours.
Selection from the following topics: physics of crystal growth, lattice defects, impurity diffusion, ion-implantation, thin film growth and plasma etching. Physics of characterization techniques utilizing resistivity, carrier mobility and lifetimes, electrons, x-rays, ions, Rutherford backscattering, neutron activation analysis, positron annihilation spectroscopy, deep-level transient spectroscopy.

PHYS 5381. MECHANICS & HEAT FOR TEACHERS. 3 Hours.
This course is intended for students who wish to achieve a higher level of knowledge and effectiveness in fundamental physics (not available for M.S. or Ph.D. credit in Physics). Topics include: 1) Newton's laws of motion, gravitation, and planetary motion; 2) the basic laws of thermal and statistical physics; 3) oscillatory motion including waves and sound. Replaceable experiments will be demonstrated throughout the course.

PHYS 5382. ELECTROMAGNETISM FOR TEACHERS. 3 Hours.
This course is intended for students who wish to achieve a higher level of knowledge and effectiveness in fundamental physics (not available for M.S. or Ph.D. credit in Physics). Topics include: 1) Static charges, current flow, electric and magnetic fields; 2) simple DC/AC electrical circuits including examples from household circuit and practical electronic devices; 3) light and optics including examples such as cameras, microscopes and telescopes. Replaceable experiments will be demonstrated throughout the course.

PHYS 5383. MODERN PHYSICS FOR TEACHERS. 3 Hours.
This course is intended for students who wish to achieve a higher level of knowledge and effectiveness in fundamental physics (not available for M.S. or Ph.D. credit in Physics). Topics include: 1) Introduction to special relativity and quantum theory; 2) light and radiation; 3) applications to modern electrical devices; 4) nuclear and particle physics.

PHYS 5385. PHYSICS LAB TECHNIQUES FOR TEACHERS. 3 Hours.
This course is intended for students who wish to achieve a higher level of knowledge and effectiveness in fundamental physics (not available for M.S. or Ph.D. credit in Physics). Experiments demonstrating various topics are covered. Experiments include gravitational acceleration heat flow, harmonic motion, sound, electric magnetic fields, electric circuits, optic, x-rays and nuclear radiation.

PHYS 5391. SPECIAL TOPICS IN PHYSICS. 3 Hours.
Topics in physics, particularly from areas in which active research is being conducted, are assigned to individuals or small groups for intensive investigations. May be repeated for credit.

PHYS 5393. READINGS IN PHYSICS. 3 Hours.
Conference course. May be repeated for credit.

PHYS 5394. RESEARCH IN PHYSICS. 3 Hours.
Conference course with laboratory. May be repeated for credit.

PHYS 5398. THESIS. 3 Hours.

PHYS 5694. RESEARCH IN PHYSICS. 6 Hours.
Conference course with laboratory. May be repeated for credit.

PHYS 5698. THESIS. 6 Hours.

PHYS 6301. METHODS OF APPLIED PHYSICS I--ELECTRONICS. 3 Hours.
The analysis and design of electronic circuits for use in the laboratory. Transistors and integrated circuits in analog instrumentation. Digital logic. Information theory and signal processing.

PHYS 6302. METHODS OF APPLIED PHYSICS II--COMPUTERS IN PHYSICS. 3 Hours.
Applications of computers in physics. Acquisition and analysis of experimental data. Vector and parallel processing, image processing, simulation.

PHYS 6303. METHODS OF APPLIED PHYSICS III--SPECTROSCOPY. 3 Hours.
The principles (interactions, cross-sections, elastic and inelastic scattering, diffraction, coherence), the methodologies (sources, detectors, visualization), and applications (structure, dynamics, composition, excitations) of neutral and charged particle spectroscopies to condensed matter physics and materials science.

PHYS 6304. APPLIED PHYSICS INTERNSHIP. 3 Hours.
Applied physics and engineering research and training in industry or other science or engineering departments of U.T. Arlington or other institutions requiring applied physicists. Faculty supervision and submission of technical progress reports required.

PHYS 6391. SELECTED TOPICS IN APPLIED PHYSICS. 3 Hours.
Topics chosen from research areas in the Department of Physics or at one of the institutions or corporations participating in the traineeship program in applied physics; emphasis on industrial and engineering applications. May be repeated for credit.

PHYS 6399. DISSERTATION. 3 Hours.

PHYS 6604. APPLIED PHYSICS INTERNSHIP. 6 Hours.
Applied physics and engineering research and training in industry or other science or engineering departments of U.T. Arlington or other institutions requiring applied physicists. Faculty supervision and submission of technical progress reports required.

PHYS 6699. DISSERTATION. 6 Hours.

PHYS 6904. APPLIED PHYSICS INTERNSHIP. 9 Hours.
Applied physics and engineering research and training in industry or other science or engineering departments of U.T. Arlington or other institutions requiring applied physicists. Faculty supervision and submission of technical progress reports required.

PHYS 6999. DISSERTATION. 9 Hours.

PHYS 7399. DOCTORAL DEGREE COMPLETION. 3 Hours.
This course may be taken during the semester in which a student expects to complete all requirements for the doctoral degree and graduate. Enrolling in this course meets minimum enrollment requirements for graduation, for holding fellowships awarded by The Office of Graduate Studies and for full-time GTA or GRA positions. Students should verify that enrollment in this course meets other applicable enrollment requirements. To remain eligible in their final semester of study for grants, loans or other forms of financial aid administered by the Financial Aid Office must enroll in a minimum of 5 hours as required by the Office of Financial Aid. Other funding sources may also require more than 3-hours of enrollment. Additional hours may also be required to meet to requirements set by immigration law or by the policies of the student's degree program. Students should contact the Financial Aid Office, other sources of funding, Office of International Education and/or their graduate advisor to verify enrollment requirements before registering for this course. This course may only be taken once and may not be repeated. Students who do not complete all graduation requirements while enrolled in this course must enroll in a minimum of 6 dissertation hours (6699 or 6999) in their graduation term. Graded P/F/R.