PHYSICS AND ASTRONOMY

Courses

ASTR 533 - Advanced Observational Astronomy (1-3 Credits)
Development of a combination of observational techniques and facility at reduction of data. A maximum of eight hours per week of observation, data reduction, and consultation. Offered each semester by arrangement with the department.

ASTR 534 - Advanced Observational Astronomy (1-3 Credits)
A continuation of ASTR 533. Up to eight hours per week of observation, data reduction, and consultation.

ASTR 599 - Topics in Astronomy (1-3 Credits)
Readings and research on selected topics in astronomy. Course content varies and will be announced in the schedule of classes by title.

PHYS 501 - Quantum Physics I (3 Credits)
A self-contained treatment of quantum theory and its applications, beginning with the Schrodinger equation.
Prerequisites: C or better in PHYS 307 and MATH 242.

PHYS 502 - Quantum Physics II (3 Credits)
Advanced topics in quantum physics, plus topics in special relativity, high-energy physics, and cosmology.
Prerequisites: C or better in PHYS 501.

PHYS 503 - Mechanics (4 Credits)
Classical mechanics of particles, systems, and rigid bodies; discussion and application of Lagrange's equations, introduction to Hamiltonian formulation of mechanics.
Prerequisites: PHYS 206 or PHYS 211, MATH 242 or MATH 520.

PHYS 504 - Electromagnetic Theory (4 Credits)
Field theory of electric and magnetic phenomena; Maxwell's equations applied to problems in electromagnetism and radiation.
Prerequisites: C or better in PHYS 503.

PHYS 506 - Thermal Physics and Statistical Mechanics (3 Credits)
Principles of equilibrium thermodynamics, kinetic theory, and introductory statistical mechanics.
Prerequisites: C or better in PHYS 306.

PHYS 509 - Solid State Electronics (4 Credits)
Topics include: basic electrical circuits; electronic processes in solids; operation and application of individual solid state devices and integrated circuits. Three lecture and three laboratory hours per week.
Prerequisites: PHYS 207 or PHYS 212.

PHYS 510 - Digital Electronics (3 Credits)
Basic operation of digital integrated circuits including microprocessors. Laboratory application of microcomputers to physical measurements.
Prerequisites: C or better in PHYS 509.

PHYS 511 - Nuclear Physics (4 Credits)
An elementary treatment of nuclear structure, radioactivity, and nuclear reactions. Three lecture and three laboratory hours per week.
Prerequisites: C or better in PHYS 501.

PHYS 512 - Solid State Physics (4 Credits)
Crystal structure; lattice dynamics; thermal, dielectric, and magnetic properties of solids. Free electron model of metals. Band structure of solids, semi-conductor physics. Three lecture and three laboratory hours per week.
Prerequisites: PHYS 502.

PHYS 514 - Optics, Theory, and Applications (4 Credits)
Geometrical and physical optics; wave nature of light, lenses and optical instruments, interferometers, gratings, thin films, polarization, coherence, spatial filters, and holography. Three lecture and three laboratory hours per week.
Prerequisites: PHYS 306.

PHYS 515 - Mathematical Physics I (3 Credits)
Analytical function theory including complex analysis, theory of residues, and saddlepoint method; Hilbert space, Fourier series; elements of distribution theory; vector and tensor analysis with tensor notation.
Prerequisites: MATH 242.

PHYS 516 - Mathematical Physics II (3 Credits)
Group theory, linear second-order differential equations and the properties of the transcendental functions; orthogonal expansions; integral equations; Fourier transformations.
Prerequisites: PHYS 515.

PHYS 517 - Computational Physics (3 Credits)
Application of numerical methods to a wide variety of problems in modern physics including classical mechanics and chaos theory, Monte Carlo simulation of random processes, quantum mechanics and electrodynamics.
Prerequisites: C or better in PHYS 212 and MATH 142.

PHYS 521 - Biophysics (4 Credits)
Principles of physics applied to living systems: diffusion, friction, low Reynolds-number world, entropy, free energy, entropic/chemical forces, self-assembly, molecular machines, membranes.
Prerequisites: MATH 142, PHYS 212, CHEM 112, BIOL 102.

PHYS 531 - Advanced Physics Laboratory I (1-3 Credits)
A laboratory program designed to develop a combination of experimental technique and application of the principles acquired in formal course work. A maximum of eight hours per week of laboratory and consultation.

PHYS 532 - Advanced Physics Laboratory II (1-3 Credits)
A continuation of PHYS 531. Up to eight hours per week of laboratory and consultation.

PHYS 541 - Advanced Experimental Physics I (4 Credits)
Continuation of PHYS 310. Optical apparatus (telescope, microscope, interferometer) and advanced project planning including equipment design and budgeting.
Prerequisites: C or better in PHYS 310.

PHYS 542 - Advanced Experimental Physics II (4 Credits)
Continuation of PHYS 541. Study of topics from advanced optics, astronomy, biophysics, digital electronics, nuclear/particle physics, or solid state physics, plus conduction of a physics experiment, including a written paper and an oral presentation.
Prerequisites: C or better in PHYS 541.

PHYS 546 - Introduction to Astrophysics (3 Credits)
This is an astrophysics course for physics students. The course will cover the basics of observational techniques, structure and evolution of stars, interstellar medium and star formation, structure and properties of the Milky Way and nearby galaxies, and generation and transfer of radiation in astrophysical environments.
Prerequisites: C+ or better in PHYS 307.

PHYS 599 - Topics in Physics (1-3 Credits)
Readings and research on selected topics in physics. Course content varies and will be announced in the schedule of classes by title.

PHYS 701 - Classical Mechanics (3 Credits)
Generalized coordinates, Lagrangian and Hamiltonian formulations, variational principles, transformation theory, and Hamilton-Jacobi equation.

PHYS 703 - Classical Field Theory I (3 Credits)
Development of classical fields; Maxwell's equations; boundary value problems; radiation theory.

PHYS 704 - Classical Field Theory II (3 Credits)
A continuation of PHYS 703.

PHYS 706 - Statistical Thermodynamics (3 Credits)
Statistics of Boltzmann, of Fermi and Dirac, and of Bose and Einstein, with applications.

PHYS 708 - General Relativity and Cosmology (3 Credits)
Introduction to the basic concepts of general relativity and a discussion of problems of current interest.
Prerequisite or Corequisite: PHYS 701, PHYS 704.

PHYS 711 - Quantum Mechanics I (3 Credits)
A development of non-relativistic quantum mechanics.

PHYS 712 - Quantum Mechanics II (3 Credits)
A continuation of PHYS 711.

PHYS 713 - Advanced Quantum Theory (3 Credits)
Second Quantization. Relativistic formulations of quantum mechanics.
Prerequisites: PHYS 712.

PHYS 714 - Quantum Field Theory (3 Credits)
Theory of quantized fields. Introduction to renormalization. A continuation of PHYS 713.
Prerequisites: PHYS 713.

PHYS 715 - Many-Body Quantum Theory (3 Credits)
Effective field theory, particle -hole, quasiparticles.
Prerequisite or Corequisite: PHYS 713.

PHYS 721 - Subatomic Physics (3 Credits)
Nuclear physics, mainly from the experimental standpoint.

PHYS 723 - Elementary Particles I (3 Credits)
Introduction to elementary particles. The quark model. Symmetry principles and conservation laws. Calculation of cross sections and decay rates using Feynman rules. Accelerators, particle detectors, and experiments.
Prerequisites: PHYS 701, PHYS 703, PHYS 711.

Corequisite: PHYS 712.

PHYS 724 - Elementary Particles II (3 Credits)
Experimentally accessible processes and their description using the framework developed in PHYS 723. Gauge theories and the standard model. Particle experiments for the next decade and their underlying physics descriptions.
Prerequisites: PHYS 723

PHYS 725 - Solid State Physics (3 Credits)
The crystalline state of matter and its main characteristics. Electric and magnetic properties of metals, semiconductors, and insulators.

PHYS 726 - Superconductivity (3 Credits)
Theory and description of conventional and high temperature superconductors and their properties.

PHYS 727 - Magnetic Resonance (3 Credits)
Basic theory. Electron spin resonance. High resolution and wideline nuclear magnetic resonance. MÃƒÂ¶ssbauer effect. Magnetic resonance and dielectric relaxation.

PHYS 728 - Quantum Optics - Understanding Light-Matter Interactions (3 Credits)
Semi-classical and fully quantum-mechanical treatments of interactions between matter and electromagnetic fields on the microscopic level.
Prerequisites: Undergraduate quantum mechanics.

PHYS 729 - Applied Group Theory (3 Credits)
Groups and representations. Full rotational group. Angular momentum. Ligand field theory. Application to atomic, molecular, and nuclear physics.

PHYS 730 - Graduate Seminar (1 Credit)
Presentation by the student of a designated topic. May be repeated for credit.

PHYS 731 - Extragalactic Astrophysics (3 Credits)
Extragalactic astrophysics, including nearby and distant galaxies, active galaxies, galaxy clusters, large-scale structure, galaxy formation/evolution, scale structure, galaxy formation/evolution, basics of cosmology, cosmic radiation backgrounds, and observation constraints on cosmological models.
Prerequisites: PHYS 701, PHYS 703, and ASTR 211 or equivalent.

PHYS 740 - Selected Topics in Physics (1-3 Credits)
Course content varies and will be announced in the schedule of classes by title.

PHYS 745 - Topics in Nuclear Physics (1-3 Credits)
Course content varies and will be announced in the schedule of classes by title.

PHYS 746 - Principles of Astrophysics (3 Credits)
This is an astrophysics course for physics graduate students. The course will cover the basics of observational techniques, structure and evolution of stars, interstellar medium and star formation, structure and properties of the Milky Way and nearby galaxies, and generation and transfer of radiation in astrophysical environments.
Prerequisites: C+ or better in PHYS 307, PHYS 503, PHYS 506.

PHYS 750 - Topics in Solid State Physics (1-3 Credits)
Course content varies and will be announced in the schedule of classes by title.

PHYS 751 - The Physics of Radiation Therapy (3 Credits)
Description of ionizing and non-ionizing radiation, interaction of radiation withmatter, and radiation detection and dosimetry.

PHYS 752 - Health Physics - Radiation and Nuclear Physics (3 Credits)
Radioactive decay and ionizing radiation. Calculation of occupational exposure and biological effects of radiation exposure. Introduction to Radiological Control Systems, Shielding, Dose Determination, Safety Protocols.

PHYS 753 - The Physics of Medical Imaging (3 Credits)
Describing basics of imaging science, x-ray imagingmodalities including basic principles, detectors, scattered radiation, planar imaging, CT, fluoroscopic imaging, nuclear medicine imaging, ultrasound and MRI, and computers in imaging.

PHYS 755 - Topics in Theoretical Physics (1-3 Credits)
Course content varies and will be announced in the schedule of classes by title.

PHYS 760 - Research (1-6 Credits)
Introduction to and the application of the methods of research.

PHYS 761 - Research (1-6 Credits)
Introduction to and the application of the methods of research.

PHYS 781 - Astronomy for Teachers (3 Credits)
A one semester survey of astronomy. Observational techniques and current developments. Primarily for M.A.T./I.M.A. and M.Ed. students. Not available for M.S. and Ph.D. credit in physics.

PHYS 782 - Topics in Contemporary Physical Sciences for Teachers (3-4 Credits)
Discussions designed to provide teachers with simple physical explanations of subjects including: nuclear energy, black holes, quarks, strange particles, perception of color, integrated circuits, computers, TV games, and other topics of current interest. Primarily for M.A.T. and M.Ed. students. Not available for M.S. and Ph.D. credit in physics.

PHYS 783 - Modern Physics for Teachers (3 Credits)
Basic concepts of modern physics.The experimental basis for quantum theory and the theory of relativity. Fundamental concepts of modern physics. Primarily for M.A.T. and M.Ed. students. Not available for M.S. and Ph.D. credit in physics.

PHYS 784 - Topics in Light and Sound for Teachers (3 Credits)
Topics in modern optics and acoustics are discussed in a framework appropriate for school teachers. Primarily for M.A.T. and M.Ed. students. Not available for M.S. and Ph.D. credit in physics.

PHYS 785 - Electronics for Teachers (3 Credits)
Basic electronics with emphasis on measurement and laboratory procedures. Operation and application of semiconductor devices and integrated circuits. Primarily for M.A.T. and M.Ed. students. Not available for M.S. and Ph.D. credit in physics.

PHYS 786 - Teaching Physics on the Internet (3 Credits)
Web-based resources for assigning and grading individualized homework and tests and for creating instructional units in physics and physical sciences. Not available for M.S./Ph.D. physics majors.

PHYS 787 - Design of Physics Laboratory and Demonstration Experiments for Teachers (3 Credits)
Design and performance of demonstrations and experiments to display physical phenomena to students. Qualitative and quantitative experiments. Primarily for M.A.T. and M.Ed. students. Not available for M.S. and Ph.D. credit in physics.

PHYS 788 - Physics for AP Teachers (3 Credits)
Preparation of teachers for developing and teaching an advanced placement course in physics. Primarily for M.A.T./I.M.A. and M.Ed. students. Not available for M.S. of Ph.D. credit in physics.

PHYS 789 - Physics for Teachers of Mathematics (3 Credits)
Teacher preparation for creating and solving word problems using conservation laws and symmetries found in physics and physical science and linked to the South Carolina Mathematics Standards. Primarily for M.A.T./I.M.A. and M.Ed. students. Not available for M.S. of Ph.D. credit in physics.

PHYS 799 - Thesis Preparation (1-9 Credits)
CL: 2020.

PHYS 899 - Dissertation Preparation (1-12 Credits)
CL: 2020.