107A-B. Intermediate Electricity and Magnetism (3-3)
Prerequisites: PHYS 105A, MATH 81. (A) Mathematical analysis of electrostatics and magnetostatics, Gauss' law, solutions of Laplace's equation, images, theory of conduction, magnetic potentials. (B) Motion of ions in electric and magnetic fields, electromagnetic induction, Maxwell's equations and wave propagation, electron theory, and magnetic properties.

110. Physical Optics (3)
Prerequisites: PHYS 4C, MATH 81. Theory of optical phenomena; wave theory of light with applications to optical instruments; interference and diffraction phenomena, dispersion, polarization, coherence, and laser phenomena. Practical experience in using lasers and optical instruments. (2 lecture, 3 lab hours)

115. Quantum Mechanics (3)
Prerequisites: PHYS 102, 105A, 170A (may be taken concurrently), MATH 81. Historical background, postulates, meaning, and methods of quantum mechanics; applications to atomic phenomena.

130. Advanced Laboratory (2)
Prerequisite: PHYS 102. Advanced experiments in atomic and nuclear physics. Radiation safety. Gamma ray, X-ray, and particle detection and spectroscopy. X-ray fluorescence analysis, Mossbauer, coincidence, Compton scattering and radiation attenuation experiments. Statistics, error analysis. Projects. (6 lab hours)

136. Radiation Physics (3)
Prerequisite: PHYS 102. The interaction of radiation with matter: photoelectric, Compton and pair production processes, neutron and charged particle interactions, linear energy transfer, quality factor, attenuation coefficients, shielding. Biological effects, RBE, internal dose, permissible exposures, beneficial application. Instrumentation.

140. Thermodynamics and Kinetic Theory (3)
Prerequisite: MATH 81. Fundamental concepts and laws of classical thermodynamics. Rudiments of kinetic theory and statistical thermodynamics with application to physical and chemical systems.

145. Geophysics (3)
Prerequisites: PHYS 2A, 2B or 4A, MATH 75. Basic principles of physics applied to the solution of geological problems, rotation and figure of the earth, the gravity field, seismology and the earth's interior, geomagnetism, and the thermal history of the earth.

150. Astrophysics (3)
Prerequisites: MATH 75 and PHYS 2A, 2B or PHYS 4A, 4B and 4C. Introduction to celestial mechanics, spectral classification, stellar atmospheres and interiors, star formation and evolution, variable stars, neutron stars, pulsars, black holes, the nature of galaxies, and the expansion of the universe. (Formerly PHYS 175T)

162. Condensed Matter Physics (3)
Prerequisites: PHYS 102, or CHEM 110B and permission of instructor. Classification of solids; crystalline state and lattice vibrations; properties of metallic lattices and dielectrics; magnetic properties of solids; free electron theory and band theory of metals; semiconductors; imperfections.

170A. Mathematical Physics (3)
Prerequisite: MATH 81. Application of mathematical methods to the solution of problems in physics.

175T. Topics in Contemporary Physics (1-4; max total 12)
Designed to provide students with special work in such areas of physics as biophysics, modern optics, plasmas, high energy physics, solid state, chaos theory, nuclear structure, astrophysics, low temperature phenomena. Some topics may have labs.

180. Seminar in Physics (1; max total 3)
Prerequisite: senior or graduate physics major or permission of department chair.

190. Independent Study (1-3; max total 6)
See *Academic Placement — Independent Study*. Approved for ***SP*** grading.

GRADUATE COURSES

(See *Course Numbering System*.)

Physics (PHYS)

203. Classical Mechanics (4)
Advanced treatment of classical analytical mechanics including Lagrange's and Hamilton's formulation of the laws of motion, special relativity, small oscillation theory, hydrodynamics. (Formerly PHYS 203A-B)

220A-B. Advanced Electricity and Magnetism (3-3)
Electromagnetic theory and its applications; electrostatics, boundary-value problems in electrostatics, dielectrics, multipoles, magnetostatics, Maxwell's equations, electromagnetic radiation, optical properties of materials, wave guides and resonant cavities.

222A. Quantum Mechanics I (3)
Prerequisite: PHYS 115. Quantum Dynamics: representations and pictures, path integrals, evolution operator, propagators. Angular Momentum: orbital and spin, addition. Perturbation Theory: time-independent and time-dependent problems, sudden and adiabatic approximations. Scattering: Lippman-Schwinger equations, scattering matrix, Born approximation, partial waves.

222B. Quantum Mechanics II (3)
Prerequisite: PHYS 222A. Identical Particles: fermions and bosons, second quantization. Electromagnetic Fields: radiation field, photons, coherent states, vacuum state and Casimir effect, interactions with charged particles. Relativistic Quantum Mechanics: Klein-Gordon and Dirac equations, relativistic hydrogen atom, perturbation theory and Feynman diagrams.

262. Advanced Condensed Matter Physics (3)
Binding and crystal structure, crystal electron theories, elementary excitations, transport theories, crystal defects, superconductivity.