PHYSICS

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The Physics Department offers a variety of degree tracks. Requirements for admission, fields of employment, continued areas of education, and course requirements are explained below. The requirements for graduation, which precede a student's major, are listed on page 45–"Undergraduate Requirements."

Bachelor of Arts in Applied Physics

Completion of this major prepares one for a career as a laboratory technician, systems analyst, engineering assistant, research associate, or physics associate. Continued study may include a master's degree in physics, geology, biology, environmental science, natural science, or science education, among others. It may also include doctorates in medicine, dentistry, or the previously identified fields.

The requirements for admission to this degree track are a 2.5 cumulative grade point average (CGPA) and precalculus. Students interested in this track are encouraged to make their selection of major as soon as possible.

Course requirements for the completion of the major are listed below. Course codes with an asterisk (*) have prerequisite or corequisite courses. These prerequisites and corequisites are listed with the course descriptions that follow.

Required
Lower Level Courses

Course Code	Course Title	Credits
PHYS 130*	College Physics I, Lecture	3
PHYS 1130*	College Physics I, Recitation & Laboratory	1
PHYS 131*	College Physics II, Lecture	3
PHYS 1131*	College Physics II, Recitation & Laboratory	1
PHYS 230*	Physics III, Lecture	3
PHYS 1230*	Physics III, Recitation & Laboratory	1
MATH 192*	Calculus and Analytic Geometry I	4
MATH 193*	Calculus and Analytic Geometry II	4
MATH 292*	Calculus and Analytic Geometry III	4
MATH 311*	Differential Equations for Engineers	4
CHEM 105*	General Chemistry I, Lecture	3
CHEM 1105*	General Chemistry I, Recitation & Laboratory	2
CHEM 106*	General Chemistry II, Lecture	3
CHEM 1106*	General Chemistry II, Recitation & Laboratory	2

Upper Level Courses

PHYS 270*	Statics and Dynamics I	3
PHYS 240	Digital Techniques and Applications	3
PHYS 401*	Principles and Applications of Modern Optics, Lecture	3
PHYS 1401*	Optics, Recitation & Laboratory	1
INTD 180*	Computer as a Tool in Science and Math	3

Restricted Physics electives (select a minimum of nine credits from the following courses)

PHYS 301*	Thermodynamics and Kinetic Theory	3
PHYS 271*	Statics and Dynamics II	3
PHYS 307*	Principles of Electronics: Analog Techniques & Applications, Lecture	3
PHYS 321*	Theory and Applications of Electricity and Magnetism	3
PHYS 404*	Nuclear Radiation: Theory and Applications	3
PHYS 405*	Introduction to Quantum Mechanics	3

Restricted Supporting electives (select a minimum of nine credits from the following cognate/technology courses)

BIOL 130	Principles of Biology I	4
BIOL 131*	Principles of Biology II	4
BIOL 307	Electron Microscopy	4
GEOS 111	Physical Geography	3
GEOS 113	Introduction to Astronomy	3
MATH 330*	Mathematical Statistics I	3

Or other approved courses

Bachelor of Arts in Applied Physics-Teacher Certification (Physical Science)

Completion of this major and New Jersey teacher certification prepares one for a career as a physical science teacher in elementary, middle, and high schools in which science is taught as a separate subject. Continued study may include a master's degree in education, physics, geology, biology, environmental science, or natural science.

Admission to the education certification program requires a minimum CGPA of 2.75. Eligibility for teacher certification by the New Jersey Department of Education is dependent upon completion of the curriculum requirements of a certification program, a passing score on the Praxis exam, and whatever minimum cumulative grade point average has been put into effect by the State at the time a graduate's application for certification arrives at the New Jersey Department of Education. Students who are interested in teacher certification as a physical science teacher must contact the College of Education for additional requirements necessary for admission and completion of the education certification program.

Course requirements for the completion of the major are listed below. Course codes with an asterisk (*) have prerequisite or corequisite courses. These prerequisites and corequisites are listed with the course descriptions that follow.

Course Code	Course Title	Credits
BIOL 100+	General Biology or	3
GEOS 111+	Principles of Earth Science	3
INTD 149	Human and Intercultural Relations	3
PSYC 152+	Adolescence to Adulthood	3
SOCI114+	Sociology of the Family	3

+This course may be used to simultaneously satisfy a General Studies Area requirement-see p. 45–"Undergraduate Requirements."

Applied Physics Major (Physical Science) (A minimum of 36 cr. Required)
Required (Courses codes with an asterisk have prerequisites or co-requisite courses)

PHYS 130*	College Physics I, Lecture	3
PHYS 1130*	College Physics I, Recitation & Laboratory	1
PHYS 131*	College Physics II, Lecture	3
PHYS 1131*	College Physics II, Recitation & Laboratory	1
PHYS 230*	College Physics III, Lecture	3
PHYS 1230*	College Physics III, Recitation & Laboratory	1
MATH 190*	Calculus I	3
MATH 191*	Calculus II	3
MATH 290*	Calculus III	3
MATH 310*	Differential Equations	3
CHEM 105*	General Chemistry I, Lecture	3
CHEM 1105*	General Chemistry I, Recitation & Laboratory	2
CHEM 106*	General Chemistry II, Lecture	3
CHEM 1106*	General Chemistry II, Recitation & Laboratory	2

Electives

PHYS 401*	Principles and Applications of Modern Optics, Lecture	3
PHYS 1401*	Optics, Recitation & Laboratory	1
PHYS 240	Digital Technique and Applications	3
PHYS 301*	Thermodynamics and Kinetic Theory	3
PHYS 321*	Theory and Applications of Electricity and Magnetism	3
PHYS 405*	Introduction to Quantum Mechanics	3
BIOL 130	Principles of Biology I	4
BIOL 131*	Principles of Biology II	4
GEOS 220	Physical Geology	4
GEOS 224*	Experimental Oceanography	2
MATH 330*	Mathematical Statistics I	3
BIOL 403*	Radiation Biology	4

** CERTIFICATION SEQUENCES (30 cr.)

Phase I		
EDU 250	The Education Challenge	3
LTED 330	Focus: Reading Language & Literacy	3
Phase II		
EDU 330	Focus: Development, Behavior & Learning	3
EDU 331	Focus: Field Experience II	1

These two courses, EDU 0330 and EDU 0331, must be taken concurrently.

Phase III	Fall Semester Only	
LTED 370	Secondary Reading Language & Literacy Workshop	2
EDU 371	Secondary Curriculum, Methods and Materials Workshop	4
EDU 3372	Secondary Methods of Teaching Science	2
Phase IV		
EDU 450	Classroom Management Seminar	1
EDU 470	Internship Seminar	2
LTED 470	Concurrent Language Arts Seminar	1
EDU 480	Internship	8

Bachelor of Science in Applied Physics

Completion of this major prepares one for a career as a laboratory technician, systems analyst, engineering assistant, research associate, or physics associate. Continued study may include a master's degree in physics, geology, biology, environmental science, natural science, and science education, among others. It may also include doctorates in medicine, dentistry, or the previously identified fields.

The requirements for admission to this degree track are a 2.5 CGPA and pre-calculus. Students interested in this track are encouraged to make their selection of major as soon as possible.

Course requirements for the completion of the major are listed below. Course codes with an asterisk (*) have prerequisite or corequisite courses. These prerequisites and corequisites are listed with the course descriptions that follow.

Required

Lower Level Courses

Course Code	Course Title	Credits
PHYS 140*	Physics for Engineering I, Lecture	3
PHYS 1140*	Physics for Engineering I, Recitation & Laboratory	1
PHYS 141*	Physics for Engineering II, Lecture	3
PHYS 1141*	Physics for Engineering II, Recitation & Laboratory	1
PHYS 230*	Physics III, Lecture	3
PHYS 1230*	Physics III, Recitation & Laboratory	1
MATH 192*	Calculus and Analytic Geometry I	4
MATH 193*	Calculus and Analytic Geometry II	4
MATH 311*	Differential Equations for Engineers	4
CHEM 105*	General Chemistry I, Lecture	3
CHEM 1105*	General Chemistry I, Recitation & Laboratory	2
CHEM 106*	General Chemistry II, Lecture	3
CHEM 1106*	General Chemistry II, Recitation & Laboratory	2

Upper Level Courses

PHYS 321*	Theory and Applications of Electricity and Magnetism	3
PHYS 401*	Principles and Applications of Modern Optics, Lecture	3
PHYS 1401*	Optics, Recitation & Laboratory	1
PHYS 405*	Introduction to Quantum Mechanics	3
INTD 180	Computer as a Tool in Science and Math	3

Restricted Physics electives (select a minimum of nine credits from the applied physics courses which follow)

PHYS 240	Digital Techniques and Applications	3
PHYS 270*	Statics and Dynamics I	3
PHYS 271*	Statics and Dynamics II	3
PHYS 301*	Thermodynamics and Kinetic Theory	3
PHYS 307*	Principles of Electronics	3
PHYS 404*	Nuclear Radiation: Theory and Applications	3

Restricted Supporting electives (select a minimum of nine credits from the cognate/technology courses which follow)

BIOL 130	Principles of Biology I	4
BIOL 131*	Principles of Biology II	4
BIOL 307*	Electron Microscopy	4
GEOS 111	Physical Geography	3
GEOS 113	Introduction to Astronomy	3
MATH 330*	Mathematical Statistics I	3

Or other approved courses

Two-Year Program in Applied Physics-

TRANSFER TO AN ENGINEERING COLLEGE FOR A BACHELOR OF SCIENCE IN ENGINEERING

Completion of this program prepares one to pursue a degree in engineering.

The requirements for admission to this degree track are a 2.5 CGPA and pre-calculus. Students interested in this track are encouraged to make their selection of major as soon as possible.

Course requirements for the completion of the program are listed below. Course codes with an asterisk (*) have prerequisite or corequisite courses. These prerequisites and corequisites are listed with the course descriptions that follow.

Course Code	Course Title	Credits
Semester I		
ENGL 101*	English Composition I	3
ENGL 106*	Writing Lab	1
FYE 01**	First Year Experience	3
CHEM 105*	General Chemistry I, Lecture	3
CHEM 1105*	General Chemistry I, Recitation & Lab	2
MATH 192*	Calculus and Analytic Geometry I	4
Semester II		
ENGL 102*	English Composition II	3
CHEM 106*	General Chemistry II, Lecture	3
CHEM 1106*	General Chemistry II, Recitation & Laboratory	2
MATH 193*	Calculus and Analytic Geometry II	4
PHYS 140*	Physics for Engineering I, Lecture	3
PHYS 1140*	Physics for Engineering I, Recitation & Laboratory	1
Semester III		
ECON 208	Introduction to Economy	3
GSC 101	Civilizations I	3
INTD 180	Computer as a Tool in Science and Math	3
MATH 292*	Calculus and Analytic Geometry III	4
PHYS 141*	Physics for Engineering II, Lecture	3
PHYS 1141*	Physics for Engineering II, Recitation & Laboratory	1
Semester IV		
GSC 102	Civilizations II	3
MATH 311*	Differential Equations for Engineers	4
PHYS 230*	Physics III, Lecture	3
PHYS 1230*	Physics III, Recitation & Laboratory	1
PHYS 307*	Principles of Electronics: Analog Techniques & Applications, Lecture	3

Dual Degree 3 + 2 Program in Applied Physics and Electrical Engineering

This alternative has been designed for students interested in pursuing studies in both the sciences and engineering.

New Jersey City University and the New Jersey Institute of Technology (NJIT) jointly offer a five-year program of study leading to a Bachelor of Science degree in Applied Physics from New Jersey City University and a Bachelor of Science in Electrical Engineering from the New Jersey Institute of Technology. This program combines a traditional liberal arts course of study with an intensive technical curriculum. Earning two degrees increases employment opportunities and opens the door to unlimited possibilities.

Students pursuing the dual degree program enter as full-time, degree-seeking freshmen at New Jersey City University. The first three years of their studies are spent at New Jersey City University, with some classes taken at NJIT. During these first three years, the majority of the requirements for the degree from New Jersey City University are satisfied, including General Studies courses as well as departmental requirements for the Bachelor of Science degree. During the fourth and fifth years, students enroll full-time at NJIT. During these two years the course of study is focused on the engineering courses required to complete the engineering degree, with certain designated technical courses being required by New Jersey City University for fulfillment of its degree requirements.

A BS degree in Applied Physics is awarded by New Jersey City University at the end of the fourth year and a BS degree in Electrical Engineering is awarded by NJIT at the end of the fifth year.

Students interested in this dual-degree program are strongly encouraged to select the major as soon as possible upon enrolling at New Jersey City University in consultation with a faculty advisor from the Physics Department. The advisor will assist students in planning the course of study in order to complete the program requirements within the five-year time span.

FIRST YEAR:			
1st Semester:			
CHEM 105	General Chemistry I, Lecture		3
CHEM 1105	General Chemistry I, Recitation & Laboratory		2
ENGL 101	English Composition I		3
ENGL 106	Writing Lab		1
MATH 192	Calculus I		4
FYE	First Year Experience		3
2nd Semester:			
ENGL 102	English Composition II		3
MATH 193	Calculus II		4
CHEM 106	General Chemistry II, Lecture		3
CHEM 1106	General Chemistry II, Recitation & Laboratory		2
PHYS 140	Physics I, Lecture		3
PHYS 1140	Physics I, Recitation & Laboratory		1
SECOND YEAR:			
1st Semester:			
PHYS 141	Physics II, Lecture		3
PHYS 1141	Physics II, Recitation & Laboratory		1
MATH 292	Calculus III		4
ECON 208	Introduction to Economy 3		
GENSTUDIES	Area E		3
GSC 101	Civilizations I		3
2nd Semester:			
PHYS 230	Physics III, Lecture		3
PHYS 1230	Physics III, Recitation & Laboratory		1
MATH 222	Differential Equations	(Taken at NJIT)	4
PHYS 307	Principles of Electronics: Analog Techniques & Applications, Lecture		3
FED 101C	Fundamentals of Engineering Design	(Taken at NJIT)	1
FED 101D	Fundamentals of Engineering Design	(Taken at NJIT)	1
GSC 102	Civilizations II		3
THIRD YEAR:			
1st Semester:			
PHYS 240	Digital Techniques and Applications		3
PHYS 401	Principles and Applications of Modern Optics, Lecture		3
PHYS 1401	Optics, Recitation & Laboratory		1
CHEM 305	Physical Chemistry, Lecture		3
CHEM 3305	Physical Chemistry, Recitation & Laboratory		2
ECE 231	Circuits and Systems	(Taken at NJIT)	3
CIS 113	Introduction to Computer Science I	(Taken at NJIT)	3
2nd Semester:			
PHYS 241	Microprocessors		3
PHYS 405	Introduction to Quantum Mechanics		3
ECE 232	Circuits and Systems II	(Taken at NJIT)	3
PHYS 321	Introduction to Electricity and Magnetism		3
GENSTUDIES	(See equivalency list on next page)		3

FOURTH YEAR (courses taken at NJIT):

1st Semester:		
ECE 333	Signals and Systems (3-0-3)	3
ECE 361	Electromagnetic Fields I (2-0-2)	2
ECE 372	Electronic Circuits II (3-0-3)	3
ECE 392	Electrical Engineering Laboratory II (1-2-2)	2
MECH 320	Statics and Mechanics of Materials (3-0-3)	3
2nd Semester:		
ECE 321	Random Signals and Noise (3-0-3)	3
ECE 362	Electromagnetic Fields II (3-0-3)	3
ECE 373	Electronic Circuits III (3-0-3)	3
ECE 395	Microprocessor Laboratory (0-4-2)	2
Elective	(Open: GUR) ENG 352 (3-0-3)	3
Elective	(EE Track) (3-0-3)	3

FIFTH YEAR (courses taken at NJIT):

1st Semester:		
ECE 341	Energy Conversion (3-0-3)	3
ECE 413	Introduction to Electrical Engineering Practice (1-0-1)	1
ECE 494	Electrical Engineering Laboratory III (1-2-2)	2
Elective	(Lit/Hist/Phil/STS: GUR) (3-0-3)	3
Elective	(EE Core I) (3-0-3)	3
Elective	(EE Track) (3-0-3)	3
2nd Semester:		
EE 415	Electrical Engineering Project (1-2-2)	2
Elective	(Capstone Seminar: GUR) (3-0-3)	3
Elective	(Management: GUR) (3-0-3)	3
Elective	(EE Core II) (3-0-3)	3
Elective	(EE Core Laboratory) (3-0-3)	3
Elective	(EE Track) (3-0-3)	3

EQUIVALENCY OF COURSES FOR GENERAL STUDIES REQUIREMENTS:

POLI 102 U.S. Politics (will transfer as R790-201 American National Government)

POLI 202 State and Local Government (will transfer as SS 2** Basic Social Science)

PSYC 110 Introduction to Psychology (will transfer as R830-101 Into to Psychology)

SOCI 111 Principles of Sociology (will transfer as R920-101 Principles of Sociology)

SOCI 113 Social Problems (will transfer as R920-208 Social Problems)

SOCI 141 Cultural Anthropology (will transfer as R070-204 Cultural Anthropology)

SOCI 266 Criminology (will transfer as R202-201 Intro to Criminal Justice)

Minor in Applied Physics

The Minor in Applied Physics is designed for students who wish to complement their preparation in the liberal arts. Students who may be interested in this minor are encouraged to declare their minor as soon as possible.

Course requirements for the completion of the minor are listed below. Course codes with an asterisk (*) have prerequisite or corequisite courses. These prerequisites and corequisites are listed with the course descriptions that follow.

Required Course Code	Course Title	Credits
PHYS 130*	College Physics I, Lecture	3
PHYS 1130*	College Physics I, Recitation & Laboratory	1
PHYS 131*	College Physics II, Lecture	3
PHYS 1131*	College Physics II, Recitation & Laboratory	1
PHYS 230*	Physics III, Lecture	3
PHYS 1230*	Physics III, Recitation & Laboratory	1
MATH 192*	Calculus and Analytic Geometry I	4
MATH 193*	Calculus and Analytic Geometry II	4
Restricted Electives (Select a minimum of six credits from the following courses		
PHYS 240	Digital Techniques and Applications	3
PHYS 270*	Statics and Dynamics I	3
PHYS 271*	Statics and Dynamics II	3
PHYS 301*	Thermodynamics and Kinetic Theory	3
PHYS 307*	Principles of Electronics: Analog Techniques & Applications, Lecture	3
PHYS 321*	Theory and Applications of Electricity and Magnetism	3
PHYS 401*	Principles and Applications of Modern Optics	3
PHYS 1401*	Optics, Recitation & Lab	1
PHYS 404*	Nuclear Radiation: Theory and Applications	3
PHYS 405*	Introduction to Quantum Mechanics	3

Course Descriptions

PHYS 101 Basic Concepts of Physics (3)
This is a one-semester course, which gives an overview of the basic principles of physics including mechanics, heat, electricity and magnetism, light and sound, and modern physics.

PHYS 103 Physical Principles of Telecommunications (3)
This course explores the integration of the basic physical principles and their applications to the dynamic field of telecommunications. It provides a basis for understanding the contemporary explosion in communication technologies—computers, satellites, tape, disk, fiber optics and new radio and telephone services. The central role of the computer is examined.

PHYS 107 Physics in the Arts and Media (3)
This course is designed especially for students who have an interest in art, music, and media. Its purpose is to establish connections and relationships between human esthetic expression and experience in these endeavors, and the existing important underlying physical bases. Scientific inquiry and demonstrations are used to explore color, sound, light, the ear, the eye, the role of symmetry and chaos, and electromagnetic communications, along with the interaction between technology and society.

PHYS 111 Introduction to Energy and the Environment (3)
This course deals with forms and sources of energy, including conversion for utilization, resources, and needs, and environmental and social consequences.

PHYS 130 College Physics I, Lecture (3)
Fundamental concepts and laws of mechanics, including statics, dynamics, energy-momentum conservation, and gravitation are examined in this course. Additional areas of study include behavior of fluids, vibrations, and wave motion, along with temperature, heat transfer, and calorimetry. Instruction includes four hours of lecture, demonstration, discussion, and problem-solving per week.

Prerequisite: MATH 165 Pre-Calculus

Corequisite: PHYS 1130 College Physics I, Recitation & Laboratory

PHYS 131 College Physics II, Lecture (3)
This course is a continuation of Physics 130 and covers the study of heat, including kinetic theory, the laws of thermodynamics, electrostatics, dc and ac circuits, electromagnetic interaction, and geometric and wave optics. Instruction includes four hours of lecture, demonstration, discussion, and problem-solving per week.

Prerequisite: PHYS 130 College Physics I

Corequisite: PHYS 1131 College Physics II, Recitation & Laboratory

PHYS 140 Physics for Engineering I, Lecture (3)
This course develops the concepts and laws of mechanics, especially conservation laws, and includes scalar and vector quantities, rectilinear and circular motion, equilibrium, work energy and momentum, elements of fluid statics and dynamics, and heat and thermodynamics. Instruction includes four hours of lecture, demonstration, discussion, and problem-solving per week with emphasis on applications.

Corequisite: MATH 192 Calculus and Analytic Geometry I, and PHYS 1140 Physics for Engineering I, Recitation & Laboratory

PHYS 141 Physics for Engineering II, Lecture (3)
This course is a continuation of Physics 140 and develops a conceptual, quantitative, and applied understanding of electric fields and electrostatics, dc and ac circuits, magnetic fields and properties of matter, electromagnetic waves, and geometric and wave optics. Instruction includes four hours of lecture, demonstration, discussion, and problem-solving per week with emphasis on applications.

Prerequisite: PHYS 140 Physics for Engineering I

Corequisite: PHYS 1141 Physics for Engineering II, Recitation & Laboratory

PHYS 201 The Wonders of Contemporary Physics (3)
A journey through the past 100 years of physics achievements culminates with the study of the current frontier of an expanding universe of galaxies that explores how the microworld and cosmos are intimately linked to fundamental questions concerning the origin, evolution, and possible fate of the universe itself. The course examines how elements of relativity, radiation, entropy, particle physics, fundamental forces, and grand unification theory converge and attempt to explain the cosmos.

PHYS 230 Physics III, Lecture (3)
This course examines electromagnetic wave-theory, production, propagation, and detection, applied optical techniques, modern physics, relativity and its implications, the Bohr atom, elements of atomic and nuclear structure, and radiation and its measurement. Instruction includes four hours of lecture, demonstration, discussion, and problem-solving per week with emphasis on applications.

Prerequisite: PHYS 141 Physics for Engineering II or PHYS 131 College Physics II

PHYS 240 Digital Techniques and Applications (3)
This course deals with logical design and optimization of digital computers and digital devices. It offers an introduction to number systems, codes, and Boolean Algebra. The course explores electronics and solid state components—gates, flip flops, shift registers, docks, counters, adders and other arithmetic circuits, and memory devices. Experiments include design of logic circuit using discrete and integrated circuit components.

PHYS 241 Microprocessors (3)
This class covers all the basic principles of the functioning of the INTEL 8085 microprocessor family. Machine and Assembly languages are analyzed as they apply to the instruction written in the microprocessor.

PHYS 270 Statics and Dynamics I (4)
This course studies classification and systems of forces—their resultants, geometric and analytical conditions for equilibrium, frames, trusses, moments of inertia, rotation of a rigid body, principles of work, energy, and impulse and momentum. Instruction includes four hours of lecture, demonstration, discussion, and problem-solving per week with emphasis on computer simulations and applications.

Prerequisite: PHYS 141 Physics for Engineering II, or PHYS 131 College Physics II and MATH 192 Calculus and Analytic Geometry I

PHYS 271 Statics and Dynamics II (2)
This course explores the kinetics of rigid bodies detailing the effects of forces, work, energy, impulse, and momentum, including mechanical vibrations. Instruction includes two hours of lecture, demonstration, discussion, and problem-solving per week with emphasis on computer simulations and applications.

Prerequisite: PHYS 270 Statics and Dynamics I

PHYS 301 Thermodynamics and Kinetic Theory (3)
This course studies the operational definitions of heat, internal energy, entropy, and absolute temperature along with the theory of specific heats. Thermo-

dynamic functions and relations are applied to heat engines and other physical systems and the kinetic theory of gases, viscosity, and conductivity are included.

Prerequisite: PHYS 131 College Physics II or PHYS 141 Physics for Engineering II

PHYS 307 Principles of Electronics: Analog Techniques and Applications, Lecture (3)

This course examines circuit theory, techniques of electrical measurements, principles and operation of solid state devices, such as junctions, diodes, bipolar transistors, FETs and MOSFETs, rectification and filtering, feedback, amplifiers, and nonlinear circuits. The course provides an understanding of electronics applied to various fields. Instruction includes four hours of lecture, demonstration, discussion, and problem-solving per week with emphasis on applications.

PHYS 321 Theory and Applications of Electricity and Magnetism (3)

This course examines electrostatic fields in vacuum and material media, magnetostatic fields, electromagnetic induction, magnetic fields in matter, Maxwell's equations, propagation of electromagnetic waves, in free space and matter, reflection, and radiation; guided waves.

Prerequisites: PHYS 141 Physics for Engineering II and PHYS 131 College Physics II

Corequisite: MATH 311 Differential Equations for Engineers

PHYS 401 Principles and Applications of Modern Optics, Lecture (3)

Four different areas of optics are studied in this course: wave optics (polarization, diffraction, and interference), geometric optics (lenses, mirrors, and optical instruments), and quantum; and coherent optics (lasers and fiber optics). Instruction includes four hours of lecture, demonstration, discussion, and problem-solving per week with emphasis on applications.

Prerequisite: PHYS 230 Physics III

PHYS 404 Nuclear Radiation: Theory and Applications (3)

This course considers the discovery and nature of radioactivity, nuclear decay processes, determination of half-life, interaction with various forms of matter, instrumentation and detection principles, radioactive dating and tracing procedures, sources of environmental exposure, and effects on the human body and materials.

Prerequisite: PHYS 230 Physics III

PHYS 405 Introduction to Quantum Mechanics (3)

This course is designed to give upper level physics students a basic understanding of quantum physics, including black body radiation, the photoelectric effect, the uncertainty principle, one-dimensional Schroedinger equation, the quantum mechanical oscillator, the hydrogen atom, and other selected topics. Discussion of theory and applications, including problems and demonstrations, are conducted.

Prerequisites: PHYS 230 Physics III and MATH 311 Differential Equations for Engineers

PHYS 420 Physics in Medicine (3)

This course is designed for students who wish to pursue a career in the health professions or who have an interest in applied physics problems. A variety of applied physics techniques in medicine are covered including medical imaging (X-ray, CAT scans, MRI, PET, and ultrasound imaging), fiber optics, medical lasers, nuclear medicine, and other applications.

Prerequisite: PHYS 230 Physics III

PHYS 430 Physics Research: Advanced Laboratory (4)

This course is open to junior and senior physics majors who wish to pursue independent research under the direction of a physics faculty member. Students meet with their advisors three hours per week to discuss the progress of their projects.

Prerequisites: PHYS 230 Physics III and PHYS 1230 Physics III and MATH 311 Differential Equations for Engineers

PHYS 1130 College Physics I, Recitation and Laboratory (1)

Correlated student laboratory experiments for most areas cited in PHYS 130 are presented in this course. Instruction includes structured and open-ended lab experiments with recitation.

Corequisite: PHYS 130 College Physics I, Lecture

PHYS 1131 College Physics II, Recitation and Laboratory (1)

Correlated student laboratory experiments for most areas cited in PHYS 131 are presented in this course. Instruction includes structured and open-ended lab. Experiments with recitation are performed to verify or discover the principles of physics.

Corequisite: PHYS 131 College Physics II, Lecture

PHYS 1140 Physics for Engineering I, Recitation and Laboratory (1)

Correlated student laboratory experiments for most areas cited in PHYS 140 are performed to verify or discover the principles of physics. Instruction includes structured and open-ended laboratory experiments with recitation.

Corequisite: PHYS 140 Physics for Engineering I or PHYS 130 College Physics I, Lecture

PHYS 1141 Physics for Engineering II, Recitation and Laboratory (1)

Correlated student laboratory experiments for most areas cited in PHYS 141 are performed to verify or discover the principles of physics. Instruction includes structured and open-ended laboratory experiments with recitation.

Corequisite: PHYS 141 Physics for Engineering II or PHYS 131 College Physics II, Lecture

PHYS 1230 Physics III, Recitation and Laboratory (1)

Correlated student laboratory experiments for most areas cited in PHYS 230 are performed to verify or discover the principles of physics. Instruction includes structured and open-ended laboratory experiments with recitation.

Prerequisite: PHYS 131 College Physics II or PHYS 141 Physics for Engineering II

Corequisite: PHYS 230 Physics III, Lecture

PHYS 1307 Principles of Electronics, Recitation and Laboratory (1)

Correlated student laboratory experiments for most areas cited in PHYS 307 are performed to verify or discover the principles of physics. Instruction includes structured and open-ended laboratory experiments with recitation. Computer software packages to simulate and analyze complex circuits are used.

Corequisite: PHYS 307 Principles of Electronics: Analog Techniques and Applications, Lecture

PHYS 1401 Optics, Recitation and Laboratory (1)

Correlated student laboratory experiments for most areas cited in PHYS 401 are performed in this course. Introduction includes structured and open-ended laboratory experiments with recitation to verify or discover the principles of optics. Students use computer software packages to simulate and analyze complex optical systems.

Prerequisite: PHYS 230 Physics III, Lecture

Corequisites: MATH 311 Differential Equations for Engineers and PHYS 401 Principles and Applications of Modern Optics