PHYSICS (PY)

PY 105 - Breakthroughs in Physics
Credits: 3
An exploration of historical developments, both scientific and societal, that led physicists to major breakthroughs in our understanding of the universe. Students will examine how early discoveries led to advances in rocket science, electromagnetism and quantum mechanics. In addition to gaining a deeper understanding of the material through traditional science methods, students will enhance that understanding through exploration of societal impacts and artistic expressions of the concepts.
Prerequisites: *Placement at the AQR level or completion of an FQR course or QR1.*
Note(s): Fulfills QR2 requirement; fulfills Applied QR requirement.

PY 106 - Breakthroughs in Physics with Lab
Credits: 4
An exploration of historical developments, both scientific and societal, that led physicists to major breakthroughs in our understanding of the universe. Students will examine how early discoveries led to advances in rocket science, electromagnetism and quantum mechanics. In addition to gaining a deeper understanding of the material through traditional science methods, students will enhance that understanding through exploration of societal impacts and artistic expressions of the concepts.
Prerequisites: *Placement at the AQR level or completion of an FQR course or QR1.*
Note(s): Three hours of lecture, two hours of lab per week. Fulfills QR2 and Natural Sciences requirements; fulfills Applied QR requirement.

PY 107 - Light and Color
Credits: 4
This course traces the evolution of our understanding of light and color from the earliest recorded ideas to the present. It will emphasize the crucial roles of experimentation and mathematical modeling in the creation and refinement of the contemporary theory of light, and will give students the opportunity to observe and to experiment with many of the important properties of light and color. The course will also give students a sense of the importance of light as a technological tool in the modern world. Three hours of lecture, two hours of lab per week.
Note(s): This course may not be applied toward the major in physics. Fulfills Natural Sciences requirement.

PY 108 - Sound and Music
Credits: 3
The physical principles of sound-how it is produced, propagated, and perceived. Illumination of principles will emphasize examples from music. Mechanisms used to produce different types of musical sounds will be discussed as well as the physical principles behind the reproduction of music in its many forms, such as radio, tape recorders, and CD players.
Prerequisites: *Placement at the AQR level or completion of an FQR course or QR1.*
Note(s): Fulfills QR2 requirement; fulfills Applied QR requirement.

PY 109 - Sound and Music with Lab
Credits: 4
The physical principles of sound - how it is produced, propagated and perceived. Emphasis will be placed on music and music theory and will look at some of the mechanisms used to produce different types of musical sounds as well as the physical principles guiding the development of music theory throughout history. The weekly lab sessions will provide hands-on experience in understanding the physical principles discussed in lecture.
Prerequisites: *Placement at the AQR level or completion of a FQR course or QR1.*
Note(s): Fulfills QR2 and Natural Sciences requirements; fulfills Applied QR and Scientific Inquiry requirements.

PY 110 - Astronomy
Credits: 3
An introduction to planets, stars, galaxies, and evolution of the universe. Students will learn to use and explain astronomical methods from simple stargazing to modern telescopic techniques, including mathematical and visual descriptions of data and the process of designing physical models to explain them.
Prerequisites: *Placement at the AQR level or completion of an FQR course or QR1.*
Note(s): Fulfills QR2 requirement; fulfills Applied QR requirement.

PY 111 - Astronomy with Lab
Credits: 4
Supplements the lectures of PY 110 with telescopic observations, laboratory experiments, and analysis of other astronomical data.
Prerequisites: *QR1 or placement at the AQR level or completion of an FQR course.*
Note(s): Three hours of lecture, two hours of lab per week. Fulfills Applied QR and Scientific Inquiry requirements.

PY 115 - How Stuff Works: The Physics of Everyday Technology
Credits: 2
An introduction to the physics behind common, everyday technologies. We live in a world with technology all around us, yet the principles that make those technologies possible are often invisible. Why does a car need a transmission? How is a refrigerator able to produce cold? How does sonar detect objects that we can't see with our eyes? In this course, students will learn the science behind familiar technologies and put that knowledge to work building and testing their own versions.
Prerequisites: *Placement at the AQR level or completion of an FQR course.*
Note(s): Fulfills Natural Sciences requirement; fulfills Applied Quantitative Reasoning and Scientific Inquiry requirements.

PY 130 - Introductory Physics I with Laboratory: Forces and Energy
Credits: 4
A calculus-based introduction to the concepts and principles of mechanics, emphasizing translational and rotational kinematics and dynamics, work and energy, conservation laws, and gravitation. Hands-on exploration of physical systems using computer interfaced laboratory equipment and spreadsheet modeling techniques are used to elucidate physical principles.
Prerequisites: *QR1 or placement at the AQR level or completion of a FQR course.*
Corequisites: *MA 111.*
Note(s): Five hours of lecture, guided activities, laboratory experiments, and problem-solving per week. Fulfills QR2 and Natural Sciences requirements; fulfills Applied QR and Scientific Inquiry requirements.

PY 140 - Introductory Physics II with Laboratory: Electrodynamics
Credits: 4
An introduction to electricity, magnetism, and electronics, including hands-on exploration of physical systems. Students will develop a variety of scientific skills, including gathering and analyzing data, identifying information needed to answer a scientific question, using scientific software, troubleshooting scientific instrumentation, creating and interpreting graphs, and effectively communicating the solutions to physics problems and mathematical derivations. This course introduces tools from calculus in the context of physics problem-solving.
Prerequisites: *QR 1 or placement at the AQR level or completion of an FQR course, PY 130 or appropriate score on the Physics placement exam.*
Corequisites: *MA 113.*
Note(s): Five hours of lecture, guided activities, laboratory experiments, and problem-solving per week. Fulfills AQR Requirement; fulfills Scientific Inquiry.

PY 151 - Special Topics in Physics
Credits: 1-4
A variety of topics in physics at the introductory level.
Note(s): May be repeated for credit, if on a different topic.

PY 161 - Introductory Seminar in Physics
Credits: 1
A course for first- and second-year students who are considering majoring or minoring in Physics. Students will discuss practical steps toward career goals; reflect on physics research presentations given by faculty, students, and visiting scholars; read, discuss, and present peer-reviewed journal articles related to physics; and gain hands-on experience in the Skidmore machine shop.
Note(s): Not open to those who have completed PY 210.

PY 209 - Experimental Methods in Physics
Credits: 2
Physics laboratory methods at the intermediate level. Emphasis will be on methods of error analysis, communication skills, and measurement tools commonly used by experimental physicists. Students will gain exposure to equipment such as oscilloscopes and signal generators. Through a series of experiments, students will also learn contemporary laboratory techniques; possible examples include interferometry, spectrometry, and phase-sensitive detection. By the end of the course, students should be able to design and carry out their own experimental investigations.
Prerequisites: *PY 140.*

PY 210 - Foundations of Modern Physics
Credits: 3
The significant historical discoveries leading to the development of atomic theory and quantum mechanics. Topics include discovery of the electron, blackbody radiation, the photoelectric and Compton effects, spectra, the Rutherford-Bohr atom, deBroglie waves, and Schrodinger's equation.
Prerequisites: *PY 140.*
Note(s): This course is offered in the fall semester.

PY 211 - Thermal and Statistical Physics
Credits: 4
A study of thermodynamics, statistical mechanics (both classical and quantum), and kinetic theory from a modern perspective. Using statistical concepts and stressing the microscopic point of view, the relationships among pressure, volume, and temperature of systems are discussed, as well as the transfer of energy among thermal systems.

PY 212 - Optics
Credits: 4
A survey of geometrical, physical, and quantum optics. Topics include reflection and refraction of light by plane and spherical surfaces, ray tracing, interference, Fraunhofer and Fresnel diffraction, the electromagnetic character of light, polarization, absorption, scattering and dispersion of light, photons, lasers, magneto-optics and electro-optics.
Prerequisites: *PY 210.*
Note(s): Five hours of lecture, guided activities, laboratory experiments, and problem-solving per week.

PY 213 - Electronics
Credits: 3
An introduction to solid-state electronics. Discrete circuit elements and integrated circuits are discussed and employed in both digital and analog applications. Circuit analysis, amplifiers, signal processing, logical networks, and practical instrumentation are studied.
Prerequisites: *PY 109 or PY 140.*
Note(s): Four hours of lecture and lab per week. This course is offered in the spring semester.

PY 214 - Physics Pedagogy
Credits: 1
The theory and practice of teaching college-level physics. Students will read articles from the pedagogy literature, design demonstrations and class activities, and visit courses in the department.
Prerequisites: *PY 140.*
Note(s): This course meets once a week and may be repeated for credit.

PY 215 - Physics and Society
Credits: 3
An exploration of how power determines who gets to participate in the field of physics; who decides what to research, who pays for that research, who does the work, and who gets credit. Through a series of case studies, journal papers, and essays, students will examine the history of exclusion in physics and discuss the advancements in the field of contemporary physics and its influence in contemporary America.
Prerequisites: *SSP 100.*
Note(s): Fulfills Bridge Experience requirement.

PY 218 - Acoustics
Credits: 3
An advanced study of acoustics as it applies to music. Students will explore how musical sounds are produced, propagated, and perceived, with an emphasis on the mathematical and scientific relations that allow one to predict these phenomena. Additionally, students will investigate how a sound that is produced can vary in the way it propagates and is perceived in different spaces. They will learn how to analyze a room acoustically and how to adjust that room to fit the needs of the sounds within it.
Prerequisites: *PY 140 and MA 113.*

PY 221H - Galaxies and Cosmology
Credits: 3
An overview of large-scale structure and modern cosmological models, from nearby galaxies to the entire observable universe. Topics include galaxy surveys, quasars, dark matter, and the early universe.
Prerequisites: *PY 110 or PY 111.*
Note(s): This is an honors course. Fulfills QR2 requirement.

PY 229 - Introduction to Geophysics
Credits: 4
A study of the active physical processes in the earth. Students will apply ideas and tools of physics to earth science problems by examining topics such as stress and strain, heat transport, fluid advection, gravity, seismology, and magnetism. Students will study earth phenomena including rock deformation, glacier mechanics, earthquakes, and earth's magnetic field, and conduct analysis of geophysical data and apply physical models to earth science problems. Four hours of combined lecture and lab per week. Four hours of combined lecture and lab per week.
Prerequisites: *MA 111 (can be taken concurrently) and one course in either physics or geosciences, or permission of instructor.*

PY 251 - Special Topics in Physics
Credits: 1-4
A variety of topics at the intermediate level, available to students with an interest in physics. Some examples of topics are: exploring the universe, astronomy beyond the Milky Way, atomic and molecular physics, and particle physics. Specific choice of topics will depend on student interest and background.
Prerequisites: *Prior physics course and permission of the department.*

PY 261 - Physics Seminar
Credits: 1
A discussion of research in physics, based on journal articles and oral presentations.
Prerequisites: *PY 210.*
Note(s): Physics majors must take this course at least twice by the time they graduate. This course partially fulfills the writing requirement in the major.

PY 271 - Independent Study in Physics
Credits: 1-4
Independent study in Physics. Students must arrange this course in consultation with a faculty member in the department using the Registrar's Special Permission for Independent Study form. This class can be taken for 1-4 credits.
Prerequisites: *At least one previous course in physics.*

PY 273 - Intermediate Research in Physics
Credits: 1-4
An opportunity for qualified first-year, sophomore, and junior students to pursue research in physics under the supervision of a member of the department.
Prerequisites: *Permission of instructor.*

PY 299 - Professional Internship in Physics
Credits: 1-4
Internship opportunity for students whose curricular foundations and cocurricular experience have prepared them for professional work related to the major field. With faculty sponsorship and department approval, students may extend their educational experience into such areas as physics research, environmental and material science, or electrical engineering.
Prerequisites: *PY 140.*
Note(s): Must be taken S/U.

PY 331 - Mathematical and Computational Methods in Physics
Credits: 4
An exploration of mathematical and computational techniques used to solve problems in physics. Topics include basic programming and data analysis, statistics, curve fitting and minimization, numerical solutions to differential equations, wave equations, diffusion equations, complex numbers, and Fourier analysis.
Prerequisites: *PY 210 and MA 200.*
Note(s): This course is offered in the spring.

PY 345 - Mechanics
Credits: 4
Classical mechanics at the advanced level. Emphasis is placed on the mathematical formulation of physical problems and on the physical interpretation of the mathematical solutions. Topics include Newton's laws of motion, gravitation, kinematics, and dynamics of a particle and of systems of particles, rigid-body motion, introduction to generalized coordinates, and Lagrangian and Hamiltonian mechanics.
Prerequisites: *PY 210 and MA 200.*
Note(s): This course is offered in the fall semester.

PY 346 - Electricity and Magnetism
Credits: 4
A study of the theory of classical electromagnetism. Topics include electrostatics, boundary-value problems, dielectrics and conductors, steady currents, magnetostatics, magnetic materials, electromagnetic induction, Maxwell's equations and their solutions.
Prerequisites: *PY 140 and MA 213.*
Note(s): This course is offered in the spring.

PY 348 - Quantum Mechanics
Credits: 4
The basic postulates of quantum mechanics and their meaning, Schrodinger's equation and its solutions for finite and infinite square well and spherical well potentials, the harmonic oscillator, and the hydrogen atom. The structure and behavior of simple molecular, atomic, and nuclear systems are studied.
Prerequisites: *PY 210 and MA 200.*
Note(s): This course is offered in the fall.

PY 351 - Advanced Topics in Physics
Credits: 1-4
A variety of physics topics at the advanced level. Possible options include biophysics, condensed-matter physics, nuclear and particle physics, and advanced quantum mechanics. The selection of a particular topic will be adjusted to student interest and background.
Prerequisites: *PY 210 and permission of department.*

PY 371 - Independent Study in Physics
Credits: 1-4
Advanced independent study for students with significant background in Physics. Students must arrange this course in consultation with a faculty member in the department using the Registrar's Special Permission for Independent Study form.

PY 372 - Senior Project in Physics
Credits: 3-4
An opportunity for seniors to pursue projects in physics under the supervision of a member of the department. Projects may include literature review of an advanced physics topic, design and construction of an apparatus, or improvement of an existing experiment. Each student will develop a project proposal that addresses the themes of the Senior Experience Coda in collaboration with a faculty mentor; this proposal must be approved by the Physics Department prior to enrolling in the course. This course differs from PY 371 in that it must address the themes of the Senior Experience Coda, and it differs from PY 373 in that it is not focused on the production of new knowledge through original research.
Prerequisites: *permission of department.*
Note(s): Fulfills Senior Coda Experience requirement.

PY 373 - Senior Research in Physics
Credits: 3-4
An opportunity for qualified seniors to pursue research in physics under the supervision of a member of the department.
Prerequisites: *permission of department.*
Note(s): This course partially fulfills the writing requirement in the major. Fulfills Senior Experience Coda requirement.

PY 399 - Professional Internship in Physics
Credits: 1-4
Professional experience at an advanced level for juniors and seniors with substantial academic and cocurricular experience in physics. With faculty sponsorship and department approval, students may extend their educational experience into such areas as physics research, environmental or material science, or electrical engineering.
Prerequisites: *PY 210.*
Note(s): Only three semester hours may count toward the major or minor in physics. Must be taken S/U.