PHYSICS (PHY)

PHY 101. Non-Calculus General Physics I. 3 Credit Hours.
An elementary course in physics with topics selected from mechanics of solids and fluids, kinetic theory, and heat. A thorough knowledge of high school algebra and trigonometry is a prerequisite. Because of the integration between PHY 101 and PHY 103, PHY 103 must be taken concurrently.

PHY 102. Non-Calculus General Physics II. 3 Credit Hours.
A continuation of PHY 101 with topics selected from waves, electromagnetic theory, and optics. General Physics I (either PHY 101 or PHY 105) and PHY 103 are prerequisites. Because of the integration between PHY 102 and PHY 104, PHY 104 must be taken concurrently.

PHY 103. General Physics Laboratory. 1 Credit Hour.
The activities of these laboratory courses are designed to give students taking PHY 101-102 and PHY 105-106 direct experience with the fundamental concepts that are the subjects of those courses, making these laboratory courses an integral part of PHY 101-102 and PHY 105-106. A thorough knowledge of high school algebra and trigonometry is a prerequisite. PHY 103 is a prerequisite for PHY 104. One two-hour laboratory period each full week of classes each semester.

PHY 104. General Physics Laboratory. 1 Credit Hour.
The activities of these laboratory courses are designed to give students taking PHY 101-102 and PHY 105-106 direct experience with the fundamental concepts that are the subjects of those courses, making these laboratory courses an integral part of PHY 101-102 and PHY 105-106. A thorough knowledge of high school algebra and trigonometry is a prerequisite. PHY 103 is a prerequisite for PHY 104. One two-hour laboratory period each full week of classes each semester.

PHY 105. General Physics Scientists/Engineers I. 3 Credit Hours.
An introduction to physics and the use of calculus in physical problems. Topics are selected from mechanics of solids and fluids, kinetic theory and heat. Previous experience with calculus, either in high school or college, or concurrent enrollment in college-level Calculus I is required. Because of the integration between PHY 105 and PHY 103, PHY 103 must be taken concurrently.

PHY 106. General Physics Scientists/Engineers II. 3 Credit Hours.
A continuation of PHY 105 with topics selected from waves, electromagnetic theory and optics. PHY 105 and PHY 103 are prerequisites. Because of the integration between PHY 106 and PHY 104, PHY 104 must be taken concurrently. Concurrent enrollment in college-level Calculus II is desirable but not required.

PHY 201. Fields and Waves. 3 Credit Hours.
An introduction to the physics of fields and waves, focusing primarily on electric and magnetic fields and electromagnetic waves. May include physical optics.
Prerequisites: Calculus 11 (MTH 146) and General Physics II (either PHY 102 or PHY 106).

PHY 203. Foundations of Modern Physics. 3 Credit Hours.
Introduction to the pillars of modern physics: special relativity and quantum mechanics. Includes an historical account of the theoretical and experimental development of quantum theory and an introduction to its concepts and methods. Additional topics may include, but are not limited to, the quantum physics of atoms, molecules, and solids, and contemporary applications. Prerequistites: Calculus II (MTH 146) and General Physics II (either PHY 102 or phy 106). Prior completion of PHY 201 is desirable but not required.

PHY 215. Statics. 3 Credit Hours.
A course in that branch of mechanics which deals with particles or bodies in equilibrium under the action of forces or torques. It embraces the composition and resolution of forces, the equilibrium of bodies under balanced forces and such properties of bodies as center of gravity and moment of inertia.
Prerequisites: General Physics II (either PHY 102 or PHY 106) and Calculus II (either MTH 146 or MTH 152).

PHY 231. Experimental Foundations Modern Physics. 1 Credit Hour.
Introduction to experimental methods in physics through experiments measuring fundamental properties of light and matter. Topics may include, but are not limited to, analysis of experimental data and propagation of uncertainties computer-aided data acquisition, and an introduction to instrumentation. Experimental topics may include, but are not limited to, the mass and charge of the electron, the speed of light, Planck's constant, properties of lasers and laser light, concepts of photon interference and quantum measurement, resonance and chaos in dynamical systems. One three-hour laboratory period per week. Prior completion of PHY 201 is strongly desirable but not required.
Prerequisites: Calculus II (MTH 146), General Physics II (PHY 102 or PHY 106).

Corequisite: PHY 203.

PHY 251. Spc Topic: Fundamentals of Engineering. 3 Credit Hours.
Special Topics: A J-mester course introducing fundamental technical tools for engineers, including especially, but not necessarily limited to, introductory training in engineering CAD [Computer Aided Design] and numerical analysis of engineering problems [Matlab, Maple, Octave, or similar packages]. Course may include an engineering design competition that requires hands-on work outside of class time. Some class and / or computer lab time may be required at Syracuse University or other remote location.

PHY 280. Info in Chem & Physical Sciences. 1 Credit Hour.
This course will introduce the changing information landscape in chemistry and the physical sciences to help students become effective database and "free web" searchers. Students will also become familiar with the social and ethical issues relation to the production and use of scientific information in an increasingly digital society.
Cross-listed Courses: LIB 280, CHM 280

PHY 303. Classical Electromagnetic Theory I. 3 Credit Hours.
An advanced undergraduate course in classical electromagnetic theory. PHY 303 covers vector calculus, electrostatics and magnetostatics. PHY 304 is primarily devoted to electromagnetic dynamics and, time allowing, applications.
Prerequisites: A course in differential equations (MTH 303 or MTH 304), PHY 201, and PHY 203.

PHY 304. Classical Electromagnetic Theory II. 3 Credit Hours.
An advanced undergraduate course in classical electromagnetic theory. PHY 303 covers vector calculus, electrostatics and magnetostatics. PHY 304 is primarily devoted to electromagnetic dynamics and, time allowing, applications.
Prerequisites: A course in differential equations (MTH 303 or MTH 304), PHY 201, and PHY 203.

PHY 307. Quantum Mechanics I. 3 Credit Hours.
Topics are selected from, but not limited to, the quantum nature of reality, the Schroedinger equation, square-well potentials, the simple harmonic oscillator, tunneling, angular momentum, the hydrogen atom and the periodic table.
Prerequisites: A course in differential equations (MTH 303 or MTH 304), PHY 201, and PHY 203.

PHY 308. Quantum Mechanics II. 3 Credit Hours.
Continuation of PHY 307, focusing on applications. Topics covered include, but are not necessarily restricted to, time-independent perturbation theory, variational principles, approximation, time-dependent preturbation theory, and scattering.

PHY 311. Electronics I. 4 Credit Hours.
A course in scientific (as opposed to consumer) analog electronics. Topics include use of electronic test equipment, circuit theory, analog applications of discrete passive and active devices and analog integrated circuits. Op-amp applications (amplifiers, adders, integrators, differentiators, active inductors, oscillators, active filters, etc.) are the primary interest. Other integrated circuits such as voltage regulators, function generators, multipliers and phase locked loops may be introduced as time allows. Three lecture hours and one three-hour laboratory period per week.
Prerequisites: Calculus II (MTH 146 or MTH 152) and General Physics (PHY 102 or PHY 106).

PHY 312. Electronics II. 4 Credit Hours.
A course in scientific (as opposed to consumer) digital electronics. Topics include use of electronic test equipment, digital applications of discrete passive and active devices, digital integrated circuits (gates, decoders, flip-flops, counters, shift-registers, digital memory, clocks), and analog/ digital hybrids such as comparators, analog switches and gates with Schmitt trigger inputs. Applications include bus interfacing, multiplexing, wave shaping, digitalto-analog conversion and analog-to-digital conversion. Three lecture hours and one three-hour laboratory per week.
Prerequisites: Calculus II (MTH 146 or MTH 152) and General Physics (PHY 102 or PHY 106).

PHY 321. Analytical Mechanics I. 3 Credit Hours.
An advanced undergraduate course treating mechanics in the Newtonian, Lagrangian and Hamiltonian formulations with applications. Prerequisite or corequisite: MTH 303 or MTH 304 and PHY 203.
Prerequisite: PHY 201.

PHY 322. Analytical Mechanics II. 3 Credit Hours.
An advanced undergraduate course treating mechanics in the Newtonian, Lagrangian and Hamiltonian formulations with applications.
Prerequisites: A course in differential equations (MTH 303 or MTH 304), PHY 201, and PHY 203.

PHY 331. Atomic & Nuclear Physics Laboratory. 1 Credit Hour.
Experimental topics are drawn from, but not limited to, microwave optics and the physics of the nucleus. One three-hour laboratory period each week for one semester.
Prerequisite: PHY 203.

PHY 333. Computational Physics. 3 Credit Hours.
An introduction to computer techniques and simulations emphasizing problem solving in physics and the use of statistical, differential, integral, graphical, and numerical methods. Examples will be drawn from classical, statistical, and quantum mechanics and will include numerical integration, differentiation, and the solution of ordinary and partial differential equations, using programs such as Exel, Maple, Matlab, Mathematica etc.
Prerequisites: MTH 145 and MTH 146.

Corequisite: MTH 245.

Cross-listed Courses: CSC 333

PHY 341. Physics of NMR. 1 Credit Hour.
Nuclear magnetic resonance (NMR) spectroscopy is an analytical chemistry technique commonly used in research for determining the content and purity of a sample as well as its molecular structure. NMR is also the basis of magnetic resonance imaging (MRI), which is a non-invasive medical imaging technique that is used to create detailed anatomical images. This course explores the underlying physics of NMR at the nuclear level, how NMR spectrometers work, and how these instruments can measure material-dependent quantities such as T1 and T2 times. One lecture hour and two laboratory hours each week for six weeks. Credit cannot be taken for both PHY 431 and this course.
Prerequisites: MTH 145 and either PHY 102 or PHY 106.

Cross-listed Courses: PHY 431

PHY 350. Principles of Astrophysics. 3 Credit Hours.
An introduction to the application of physical principles such as classical mechanics, thermodynamics, E&M, and modern physics to understand the structure and evolution of stars, galaxies, and the Universe. Topics cover a large and representative fraction of the main elements of modern astrophysics, including stellar physics, stellar evolution, and stellar remnants; the interstellar medium; galactic structure; and big band cosmology. Prior completion of AST 101 or AST 102 is strongly desirable but not required. Three lecture hours weekly.
Prerequisite: PHY 203.

Corequisite: MTH 304.

Cross-listed Courses: AST 350

PHY 390. Independent Study in Physics. 1-3 Credit Hours.
A student who wishes to pursue an independent study project for academic credit must submit, prior to registration, a proposed plan of study that includes the topic to be studied and goal to be achieved, the methodology to be followed, schedule of supervision, end product, evaluation procedure and number of credits sought. The proposal must be approved by the supervising faculty member, the department chair and the academic dean. It will be kept on file in the dean of arts and science's office.

PHY 399. Independent Study. 3 Credit Hours.

PHY 401. Mathematical Physics. 3 Credit Hours.
Topics are selected from, but not limited to, matrix algebra, complex analysis, Fourier series and Fourier analysis, classical functions of mathematical physics (orthogonal polynomials, Bessel functions, gamma function,...) and applications.
Prerequisites: General Physics 11 (PHY 102 or PHY 106) and a course in differential equations (MTH 303 or MTH 304).

PHY 403. Physical Optics. 3 Credit Hours.
An intermediate course in physical optics, designed for senior physics majors, treating interference, diffraction, absorption, polarization and other aspects of electromagnetic wave phenomena.
Prerequisite: PHY 303.

PHY 405. Statistical Physics. 3 Credit Hours.
This course deals with statistical methods applied to systems of particles, statistical thermodynamics and the statistical treatment of quantized systems. Applications to diverse topics such as ideal and non-ideal gases, black body radiation, metallic conduction and magnetic effects are developed. Prerequisite or corequisite: PHY 321.
Prerequisite: PHY 203.

PHY 407. Condensed Matter Physics. 3 Credit Hours.
Structure and binding of solids, electrical, magnetic and optical properties. Prerequisite or co-requisite: PHY 307.

PHY 408. Nuclear Physics. 3 Credit Hours.
Problems of nuclear forces, structure and stability, nuclear reactions.
Prerequisite: PHY 307.

PHY 431. Advanced Physics Laboratory. 1 Credit Hour.
Experimental topics are selected from, but not limited to, x-ray physics and applications such as atomic shell structure and crystal structure. One three-hour laboratory period each week for one semester.
Prerequisite: PHY 203.

Cross-listed Courses: PHY 341

PHY 441. Research Projects in Physics. 1-3 Credit Hours.
A laboratory course designed to apply the principles and techniques of experimental and/or theoretical physics to a senior project. The student engages in one or more research projects under the direction of one of the staff. One equivalent laboratory period per credit weekly for one year.
Prerequisite/corequisite: PHY 280.

PHY 476. Physics Capstone. 3 Credit Hours.
Capstone to the physics major. Independent research in collaboration with a faculty supervisor. (The nature of the project will vary with student interests and goals and faculty resources, but may include library research, creative work, theoretical or computational research, or laboratory work.) Students will give formal oral presentations on their research and wrtie a comprehensive thesis on the work. Open to senior majors in physics and others with the consent of the program director. May be pursued in conjunction with honors theses if the projects are compatible with the requirements of each program, and with the prior consent of both programs. For students in the Bachelors-Masters engineering program with Syracuse University, may be pursued in conjunction with engineering projects at Syracuse if compatiblie with the requirements of each program, and with the prior consent of the program director. (Such projects must also have a Le Moyne College faculty supervisor.) Open to senior majors in physics and others with the consent of the program director.

PHY 490. Physics Internship. 1-6 Credit Hours.
Participation in a field learning experience related to the area of physics. The student will report as required to the faculty member assigned to supervise this field experience and is expected to evaluate the experience and relate it to his or her academic program. Three hours of field work per week for 14 weeks will be required to generate one credit.
Prerequisites: junior standing and permission of the department chair.

PHY 491. Physics Internship. 1-6 Credit Hours.
Participation in a field learning experience related to the area of physics. The student will report as required to the faculty member assigned to supervise this field experience and is expected to evaluate the experience and relate it to his or her academic program. Three hours of field work per week for 14 weeks will be required to generate one credit.
Prerequisites: junior standing and permission of the department chair.