

## Department of Physics

### Physics Course Descriptions

Note about frequency of course offerings: Physical Science is offered each term while the introductory sequences of College and University Physics are offered yearly. Some upper division courses are offered yearly; others at intervals of more than a year or "As warranted."

#### PHYS 195, 295, 395, 495 – Special Topics (1-12)

#### PHYS 198, 298, 398, 498 – Tutorial (1-3)

**PHYS 100 – Physical Science (3)** A course for non-science majors and constructed to meet the needs and requirements for Early Childhood and Childhood Education Majors. The laboratory activities are the central focus of the class, using active inquiry and collaborative group work to guide students toward discovering the nature of physical phenomena. The topics studied are chosen broadly from physics, chemistry, and astronomy. Lab required. Gen Ed: SP & LB credit. Fall and Spring.

**PHYS 101 – College Physics I (4)** This is first of the two terms sequence (PHYS 202 as the second sequence) of algebra based introductory physics covering a wide range of topics in translational and angular motion, force, gravity, work-energy, solids, waves, sound, heat and thermodynamics. It places a greater emphasis on inquiry based conceptual understanding and development of problem solving skills. The laboratory work is an integral part of the course, which provides hands-on experience on designing and investigating the laws of physics by performing a number of experiments. Lab required. Gen Ed: SP & LB credit. Fall.

**PHYS 103 – University Physics I (4)** This is the first course in the sequence intended for physics majors, 3/2 engineering, and other science majors who want a more detailed introduction to physics with calculus as a corequisite. Topics covered fall under the heading of mechanics; i.e. motion, Newton's laws, dynamics, work, energy, momentum, and rotation. Emphasis is given on Inquiry based learning, hands-on experience, and problem solving skills. Lab required. Corequisite: MATH 151. Gen Ed: SP & LB. Fall.

**PHYS 104 – University Physics II (4)** Part II of the calculus-based sequence focusing on the studies of electric charges, potential, fields, circuits, magnetism and electromagnetic interactions. Accompanying laboratory activities span the topical coverage. Lab required. Prerequisite: PHYS 103. Corequisite: MATH 152. Gen Ed: SP & LB credit. Spring.

**PHYS 111 – Laser and Light (3)** Studies of ordinary light that led to the development of the LASER, a wonderful invention of modern times. Studies, including lab experiments, of the nature and behavior of light: reflection, refraction, polarization, interference, diffraction, absorption and emission, the formation of images, color science, holography, fiber optics, the human eye and optical phenomena in the natural world such as rainbows, Northern lights and mirages. Gen Ed: SP credit. As warranted, usually in Winterim.

**PHYS 120 – Physics and Poets (3)** Like poetry, physics is a creative activity that engages the emotions and intellect. In this course, mathematics is kept at a minimum and great effort is made to illuminate the concepts, structure, and developments as well as beauty in the guiding principles of basic physics. Creative activities of a physicist will be compared to those of a poet. Elementary mathematics will be used in solving problems, which illustrate the concepts. Lecture demonstrations and laboratory projects are integral parts of the course. Gen Ed: SP credit. As warranted, usually in Winterim.

**PHYS 130 – Musical Acoustics (3)** The physics of music and sound. A study of the physical properties and processes related to the production of sound with particular attention to musical sounds: vibrations and oscillations as the sources of waves and wave properties, and those of sound waves in particular; the mathematical and psychophysical basis of musical scales; the structure and function of the human ear and how it detects and processes sounds; how musical instruments produce the sounds that they do and the similarities and differences among them; the physical properties behind musical characteristics, such as pitch, loudness and timbre (quality): aspects of environmental sound, including loudness, reflection and absorption. Examples of the phenomena are furnished by classroom demonstra-

tions using oscillation and wave apparatus and actual musical instruments. Neither high school physics nor prior musical instruction is expected or required. Students enrolling in this course are encouraged to register at the same time for PHYS 131, when it is offered. Gen Ed: SP credit.

**PHYS 131 – Musical Acoustics Laboratory (1)** Laboratory activities are designed to complement the topics studied in PHYS 130 and furnish the student with the experience of making and interpreting measurements of musical properties. Registration in PHYS 131 without co-registering in PHYS 130 is possible with permission of the instructor. Gen Ed: LB credit. As warranted.

**PHYS 202 – College Physics II (4)** Algebra based introductory physics course covering a wide range of topics in electricity, magnetism, AC circuit, optics, relativity, quantum and nuclear physics. It places a greater emphasis on inquiry based conceptual understanding and development of problem solving skills. The laboratory work is an integral part of the course, which provides hands-on experience on designing and investigating the laws of physics by performing a number of experiments. Lab required. Prerequisite: PHYS 101. Gen Ed: SP & LB credit. Spring.

**PHYS 205 – University Physics III (4)** Part III of the calculus-based sequence and covering statics, fluid, wave motion, sound, heat, and thermodynamics. Emphasis is given on inquiry based learning, hands-on experience and problem solving skills. Lab required. Prerequisite: PHYS 104. Gen Ed: SP & LB credit. Fall.

**PHYS 306 – Modern Physics (4)** Study of the phenomena that emerged from the revolutionary developments that occurred in physics around 1900. Relativity, atomic particles and structure, wave-particle duality and quantum behavior. Accompanying laboratory work includes exercises in the pioneering discoveries and experiments of the era. Lab required. Prerequisite: PHYS 205. Spring.

**PHYS 320 – Mathematics, Science, and Philosophy (3)** Selected writings by scientists and philosophers studied with concurrent progress in mathematical and scientific thought from ancient to modern times. Credit not counted toward Physics Major or Minor. Prerequisite: one year of calculus. Gen Ed: SP & WI. As warranted.

**PHYS 325 – Energy and the Environment (3)** Presents basic physical and quantitative concepts which are needed to understand energy and its environmental interaction. The physical laws come from mechanics, heat and thermodynamics, electricity, and nuclear reactions. A recurring theme is the extraction, transportation, conversion, distribution, end use, and dispersal of energy and the environmental impact of each step. Credit not counted toward the Physics Major or Minor. Prerequisite: one semester of college science. Gen Ed: SP credit. As warranted.

**PHYS 330 – Meteorology (3)** Components of the atmosphere, atmospheric dynamics, weather elements, weather phenomena and their physical courses, weather maps, weather predictions, operation and use of weather instruments. Prerequisite: one semester of college science. Gen Ed: SP credit. Fall or as warranted.

**PHYS 335 – Astronomy (3)** Topics include: solar system structure and dynamics, stellar composition and evolution, binary and multiple star systems, galactic structure and evolution, and theories describing the known universe. Included also is the study of the evening sky, constellations, planetary movement, and astronomical instrumentation. Prerequisite: one semester of college science. Gen Ed: SP credit. Spring or as warranted.

**PHYS 350 – Elements of Special Relativity (2)** Basic principles of special relativity and their application to four-dimensional space-time and particle reactions. As warranted.

**PHYS 355 – Electronics (4)** This course involves the study of electronic components and their function in electronic circuits, the application of that information to the design of circuits, and a study of the circuits themselves. Topics include: the theory, design, and function of common passive circuit elements, active discrete and integrated solid state devices, analog, and digital circuits. Lab required. Prerequisite: PHYS 205 or equivalent. As warranted.

**PHYS 360 – Advanced Physical Laboratory I (3)** Advanced experimental work in electricity, magnetism, optics, and atomic, nuclear, and solid state physics. Prerequisites: PHYS 205. Gen Ed: WI credit. Fall or as warranted.

**PHYS 361 – Advanced Physical Laboratory II (3)** Continuation of PHYS 360. Prerequisite: PHYS 306. Spring or as warranted.

**PHYS 370 – Mathematical Physics (3)** A course that integrates conceptual understanding of physics with mathematical framework. Important topics include differential

calculus, integral calculus, complex variables, vector calculus, linear algebra, and differential equations. The emphasis is on learning the mathematical models of important concepts and developing skills to solve problems. Prerequisite: MATH 152. Fall or Spring.

**PHYS 386 – Optics (3)** A study of geometrical and wave optics. Topics include: reflection, refraction, dispersion, diffraction, polarization, lenses, mirrors, optical systems, and fiber optics. Prerequisite: PHYS 205 or equivalent. As warranted.

**PHYS 390 – Nuclear Physics (3)** A study of nuclear and particle physics. Topics include: natural and artificial radioactivity, nuclear detection devices, particle scattering, models of the nucleus, and modern developments in particle physics. Prerequisite: PHYS 205 or equivalent. As warranted.

**PHYS 440 – Physics Laboratory Techniques (1-2)** Senior Physics Majors gain experience as supervisors of physics laboratories at various levels and/or serve as interns gaining experience in the college planetarium. Prerequisites: PHYS 103, 104, 205, 306, and permission. As warranted.

**PHYS 450 – Condensed Matter Physics (3)** Studies of what made the computer revolution possible. Course materials are directed towards understanding of the physics of condensed matter, formerly known as Solid State Physics. Major topics are studies of crystalline structure, electromagnetic optical properties of matter, conductors, insulators and semiconducting materials as in diodes and transistors, present day research and applications. Prerequisite: CHEM 106 and PHYS 306. As warranted.

**PHYS 465 – Physics Research I (1-3)** Designing, performing, interpreting, and summarizing research project in a field of pure or applied physics. Prerequisite: Instructor approval. Fall and Spring.

**PHYS 466 – Physics Research II (1-3)** A continuation of PHYS 465.

**PHYS 475 – Mechanics (3)** A study of classical mechanics following the theories of Newton, Lagrange, and Hamilton. Topics include: single and multiple particle motion, central forces, rigid body dynamics, moving coordinate systems, and particle interactions. Prerequisite: PHYS 205 and 370 or equivalent. Fall.

**PHYS 480 – Electromagnetic Theory I (3)** The Industrial Revolution in Europe and elsewhere was the result of progress in theoretical and experimental work in electromagnetism. The course explores the fundamental and experimental work in electromagnetism and the developments at the forefront of the technological worlds. Major Topics are electrostatics, magnetostatics, Maxwell's equations, electromagnetic waves and their interactions with matter, electromagnetic optical properties and their applications. Prerequisites: PHYS 205 and 370 or equivalent. As warranted.

**PHYS 481 – Electromagnetic Theory II (3)** Continuation and further development of topics in PHYS 480. Prerequisite: PHYS 480. As warranted.

**PHYS 484 – Thermodynamics and Statistical Mechanics (3)** A study of heat, thermodynamics, and statistical mechanics. Topics include: heat, heat engines, entropy and the second law of thermodynamics, thermodynamic potentials, phase transitions, and an introduction to statistical mechanics. Prerequisite: PHYS 205 and 370 or equivalent. Spring or as warranted.

**PHYS 490 – Quantum Physics I (3)** Exploring the world of quantum physics that cannot be explained by classical physics based on Sir Isaac Newton's work. Seeking answer to why it came to be accepted as the best description of physics. Learning the techniques of problem solving that include computational work. Major topics include old quantum theory, wave particle duality, uncertainty principle, Schrodinger's equation, square well potential, harmonic oscillator, the hydrogen atom problem, angular momentum theory, electron spin, fine structure, hyperfine structure, spin-orbit interaction, angular momentum coupling schemes and quantum theory of scattering of particles. Prerequisites: PHYS 306 and 370 or equivalent. As warranted.

**PHYS 491 – Quantum Physics II (3)** Continuation and further development of topics in PHYS 490. Prerequisite: PHYS 490. As warranted.

**PHYS 494 – Physics Seminar (1-3)** Students study and discuss contemporary research problems and results in the fields of pure and applied physics. Prerequisite: 22 semester hours of physics courses. Gen Ed: SI credit. As warranted.