SUBJECT: Physics

PHYS 101 Perspectives in Physics (4)

An introduction to the scientific enterprise: the course will treat selected issues in physics, their historical development and their effect on literature, philosophy and society at large. Topics might include Newtonian mechanics, optics, quantum physics and electromagnetism. Lectures, demonstrations, discussion, occasional laboratories. Intended for non-science majors.

PHYS 102 Light and Color (4)

An introduction to optics, the science of light and color. A broad range of topics will be examined. Subject matter may include: rainbows and the color of the sky, vision and the eye, optical instruments, photography, wave aspects of light, lasers and holography. A background in physics or mathematics is not necessary. No prerequisites.

PHYS 105 Physics for the Life Sciences I (4)

An introduction to mechanics and thermodynamics emphasizing applications to biological systems. Topics include Newton's laws of motion, equilibrium, torques, forces, conservation principles, work, energy, power, rotating systems, oscillations, temperature, heat transfer, laws of thermodynamics, fluid statics and dynamics. Intended for non-majors. Algebra and trigonometry are needed. Recommended: MATH 115 or equivalent high school mathematics. Fall and Spring.

PHYS 106 Physics for the Life Sciences II (4)

An introduction to electricity and magnetism, wave phenomena, atomic and nuclear physics emphasizing applications to biological systems. Topics include electric and magnetic forces and fields, direct and alternating current circuits, light, sound, optical instruments, relativity, quantum physics, atomic spectra, nuclear physics, radioactivity. Intended for non-majors. Prerequisite: 105. Fall and Spring.

PHYS 110 The Physics of Forensics (4)

An introduction to some forensics techniques, and the physics behind the techniques. The forensic techniques will also be discussed in context of the criminal justice system. Forensic topics such as ballistics, structural failure, blood spatter and spectrometry will be covered. Physics background will include motion, forces, energy, momentum, waves, light, and nuclear physics. Recommended: Math 115 or equivalent.

PHYS 150 The Physics of Music (4)

Relationships between music and physics. Sound sources and modes of oscillation, sound as a wave phenomenon and the characterization of sound; scales and keyboard temperament, auditorium and room acoustics; the physics of musical instruments and particular tone color effects in these instruments; electronic sound production, recording and electronic music synthesis. Intended for non-science majors.

PHYS 152 The Physics of Forensics (4)

An introduction to some forensics techniques, and the physics behind the techniques. The forensic techniques will also be discussed in context of the criminal justice system. Forensic topics such as ballistics, structural failure, blood spatter and spectrometry will be covered. Physics background will include motion, forces, energy, momentum, waves, light, and nuclear physics. Recommended: Math 115 or equivalent.

PHYS 163 Environmental Radiation (4)

An introduction to nuclear radiation in the environment from natural and man-made sources. Topics include fundamentals of nuclear structure, stability, effects of radiation on matter, radiation detection, characteristics of natural, industrial, medical, and military radiation sources, environmental mobility, and radiation protection practices and policies. Prerequisites: Math proficiency, high school biology, chemistry, or physics.

PHYS 182 Introduction to Engineering (2)

An introduction to the field of engineering and the processes and principles engineers use. Engineering will be

explored and practiced through solving problems and completing projects. The place of engineering in society and the types of engineering will also be discussed. Recommended: Math 115 or equivalent.

PHYS 187 Introduction to Meteorology (4)

A survey of the basic principles involved in understanding the earth's weather and climate. Topics include winds, fronts, cyclones, clouds and precipitation, thunderstorms, tornadoes and hurricanes, climate and climate change, global warming and ozone depletion. Prerequisite: Math proficiency. Corequisite: PHYS 187L.

PHYS 191 Foundations of Physics I (4)

Mechanics: vectors, Newton's laws, work, energy, rigid body statics and dynamics. A calculus-based course that emphasizes analytical reasoning and problem-solving techniques. Laboratory places stress on data acquisition and analysis. Prerequisite: concurrent registration in MATH 119. Fall.

PHYS 200 Foundations of Physics II (4)

Electric and magnetic fields and their sources, electric potential and electro-magnetic induction. DC and AC circuit elements and circuits. Electromagnetic waves. Emphasis on problem solving. A laboratory is included. Prerequisites: 191, concurrent registration in MATH 120. Spring.

PHYS 211 Foundations of Physics III (4)

Thermodynamics and waves. Kinetic theory and the laws of thermodynamics are developed from a mechanical point of view. Temperature, entropy and heat engines. Wave phenomena (sound and light) are developed from a unified point of view. Geometrical optics. Prerequisites: 200, concurrent registration in MATH 239. Fall.

PHYS 217 Digital Electronics (2)

Introduction to digital electronics at the integrated circuit level; logic families, gates, counters, registers and memories. Prerequisite: 200 or consent of instructor.

PHYS 222 C++ and Fortran for Scientists (2)

C++ and Fortran language fundamentals with examples from numerical analysis. Topics may include scientific data analysis and curve fitting, simulation of physical systems and numerical algorithms for integration and matrix manipulation. Prerequisites: 200 and MATH 120.

PHYS 271 Individual Learning Project (1-4)

Supervised reading or research at the lower-division level. Permission of department chair required. Consult department for applicability towards major requirements. Not available to first-year students.

PHYS 281 Problem Solving (0-1)

An introduction to solving complex problems in interdisciplinary topics which will be drawn from mathematics, computer science,and physics. Students will work in groups and present their results. Prerequisite: MATH 119 and admission to MapCores program or consent of instructor.

PHYS 310 Special Topics in Physics (2)

This course will apply basic calculus to topics on (1) linear and rotational kinematics, (2) forces, potential energy, fields, and potential, (3) conservation laws, (4) oscillations and waves, (5) electricity and magnetism, or (6) optics, kinetic theory, and modern physics. Prerequisites: education major who has completed PHYS 320 and 332 or 3 years high school science teaching experience.

PHYS 310A Topics in Mechanics (2)

Principles of mechanics including (1) linear and rotational kinematics, (2) forces, potential energy, fields, and potential, and (3) conservation laws. Onsite laboratory experiences include experiments on data analysis, the acceleration of gravity, projectile motion, Archimedes' Principle, rotational dynamics, the ballistic pendulum, and two-

body collisions. Prerequisite: 3 years high school science teaching experience or education major who has completed PHYS 320 and PHYS 332.

PHYS 310B Topics in Waves/Electromagnetism (2)

Topics include oscillations and waves, electricity and magnetism, and laboratory experiments. Prerequisite: 3 years high school science teaching experience or education major who has completed PHYS 320 and PHYS 332.

PHYS 310C Topics in Optics & Modern Physics (2)

Topics include optics, kinetic theory, modern physics, and laboratory experiments. Prerequisite: 3 years high school science teaching experience or education major who has completed PHYS 320 and PHYS 332.

PHYS 320 Modern Physics (4)

Introduction to the ideas and mathematics of quantum theory. Bohr atom, kinetic theory, black body radiation, quantum mechanics in the Schrödinger representation. Applications of quantum mechanics to selected topics in atomic, molecular or other areas of modern physics. Prerequisite: PHYS 211.

PHYS 322 C++ and Fortran for Scientists (2)

C++ and Fortran language fundamentals with examples from numerical analysis. Topics may include scientific data analysis and curve fitting, simulation of physical systems and numerical algorithms for integration and matrix manipulation. Identical to PHYS 222 except for additional required programming project. Prerequisites: 200 and MATH 120.

PHYS 332 Intermediate Physics Laboratory (1)

Experimentation for sophomores. Quantitative measurements and analysis of data. Research approach is emphasized. Prerequisite: enrollment in 211 or 320. May be repeated for credit when different experiments are done.

PHYS 338 Analog Electronics for Scientists (2)

Circuit theory, transistors, amplifiers, laboratory test equipment and integrated circuits. Prerequisite: 200 or equivalent.

PHYS 339 Physical Mechanics (4)

The dynamics of particles and systems. Gravitational theory, particle oscillations, Hamilton's principle, Lagrangian and Hamiltonian dynamics, central force motion, rigid body motion, collisions, non-inertial reference frames, coupled oscillations. Prerequisites: 211, MATH 337. MUST register for PHYS 370 at the same time.

PHYS 341 Electricity and Magnetism (4)

Electrostatic potentials and fields in vacuum and dielectric media, magnetic vector potentials and fields in vacuum and magnetic materials, electrostatic and magnetic energies, slowly varying currents. Prerequisite: 339. Spring.

PHYS 343 Thermodynamics (2)

Foundations of thermodynamics and applications. Prerequisite: 320. Spring.

PHYS 344 Statistical Mechanics (2)

Foundations of statistical mechanics. Applications to condensed matter systems, classical and quantum gases. Prerequisites: 320, 339. Spring.

PHYS 346 Quantum Mechanics I (4)

Foundations of quantum theory, wave packets, Schrödinger's equation in one dimension, raising and lowering operators. Formal structure of quantum mechanics. Angular momentum and the hydrogen atom. Prerequisite: 339. Fall.

PHYS 348 Advanced Theoretical Physics (2-4)

A continuation of 339, 341 and 346. Topics could include advanced Hamiltonian and Lagrangian mechanics, tensors, eigenvalue problems, small oscillation; Maxwell's equations, wave equation, radiation, antennas, waveguides; matrix methods in quantum mechanics, spin, perturbation theory, transitions, many-electron atoms. Prerequisites: 339, 341, or 346 (as appropriate), or permission of instructor. Spring.

PHYS 353 Applied Nuclear Physics (2)

Applications of the interaction of radiation with matter to nuclear detection techniques. Current measurement methods for charged and uncharged radiation. Prerequisite: 320.

PHYS 357 Experimental Optics (2)

Study of optical phenomena with emphasis on the needs of the experimentalist. Topics may include optical systems design, spectrum analysis, image processing, holography. Prerequisite: 320.

PHYS 358 Advanced Electronics (2)

Topics will be selected from the following in advanced analog and digital circuitry: active filters, precision circuits, low noise techniques, high frequency techniques, advanced microprocessor circuits, scientific instrumentation. Laboratory. Prerequisites: 217 and 338.

PHYS 360 Topics in Applied Physics (2)

Topics covered will vary from year to year. One such topic is physics of solids: crystal structure, lattice vibrations, band theory and electrical conduction in metals and semiconductors. Other topics such as magnetic and dielectric properties as time permits. Prerequisite: MATH 239 or CSCI 239.

PHYS 362 Topics in Modern Physics (2)

The concepts and principles presented in 191 through 320 will be used to study specific areas of physics not available elsewhere in the curriculum. Subject matter will come from such areas as elementary particle, condensed matter, nuclear, atomic, molecular physics and cosmology. Topics will be announced. Prerequisite: 320.

PHYS 363 Topics in Nuclear Physics (2)

Fundamental structure and properties of nuclei. Nuclear reactions, models and decay. Examples taken from current medical and industrial applications. Prerequisite: 320.

PHYS 364 Topics in Astrophysics (2)

Selected topics in astrophysics. Such subjects as general relativity, cosmology, stellar formation and evolution and galaxies will be studied. Prerequisites: 320, MATH 239, 337.

PHYS 365 Topics in Elementary Particle Physics (2)

Physics at the smallest known length scale. Topics will include relativistic particle decay, construction of baryons and mesons from quarks, the four fundamental interactions and corresponding gauge particles, the vision and consequences of grand unified theories, the cosmic onion. Prerequisite: 320.

PHYS 366 Topics in Relativity (2)

Foundations and application of the special and general theories of relativity. Topics covered may include: relativistic kinematics, structure of flat space-time, curvature and topologies of general space-times, Schwarzschild and Friedman solutions, cosmology, black holes and gravitational radiation. Prerequisite: 320.

PHYS 367 Optics (2)

An introduction to geometrical and physical optics: matrix optics, interferometry, thin films, Fourier optics, spatial

filtering, holography. Prerequisite: 320.

PHYS 368 Topics in Space Physics (2)

Space physics is the study of plasma which fills the space between the Sun and planets of our solar system. The course will include an introduction to plasma physics, followed by a study of the atmosphere of the Sun, the solar wind, the Earth's magnetosphere, auroras, and space weather. Prerequisite: 320.

PHYS 370 Advanced Physics Laboratory (1)

Research and experimentation for juniors. Topics selected by the student in consultation with a faculty member. May be repeated for credit when different experiments are done.

PHYS 371 Individual Learning Project (1-4)

Supervised reading or research at the upper-division level. Permission of department chair and completion and/or concurrent registration of 12 credits within the department required. Consult department for applicability towards major requirements. Not available to first-year students.

PHYS 372 Senior Research (1)

Individualized experimental or theoretical projects for seniors. Fall.

PHYS 373 Senior Thesis (1)

Oral and written report based on the work done in 372. Spring. (If a PHYS major is taking 372-373 for "Distinction in Physics," that student needs approval of the department chair and director of the Honors Thesis Program. See COLG 398 for further information.

PHYS 381 Research Seminar (0-1)

Solving complex problems in interdisciplinary topics which will be drawn from mathematics, computer science, and physics. Students will work in groups and
present their results. Prerequisites: PHYS 281 or HONR 270C and admission to MapCores program or consent of instructor.