PHYSICS (PHYS)

(Department of Physics and Engineering)

McCormick Foundation

PROFESSORS **VAN NESS**, REESE, WILLIAMS
ASSOCIATE PROFESSOR SUKOW
ASSISTANT PROFESSORS KUEHNER, D. MAZILU, I. MAZILU
INSTRUCTOR CUMMING
VISITING PROFESSOR BOLLER

MAJOR

Reminder: Majors leading to a Bachelor of Science degree from The College require at least 50 credits total in the natural sciences, mathematics, and computer science.

A **major in physics** leading to a Bachelor of Science degree requires completion of at least 46 credits including the following.

1. PHYS 111, 112, 113, 114, 210, 215, 220, 225 (ENGN 225), 230, 340; and MATH 332, 333
2. PHYS 240 (ENGN 240) or PHYS 345
3. One of the following laboratory courses: ENGN 207, 208, 251; PHYS 207, 208, 251
4. Six additional credits chosen from courses numbered 200 or above in biology, chemistry, computer science, engineering, geology, or physics, or from BIOL 111, 113; CHEM 111, 112; CSCI Science 111, 112; GEOL 100, 101; Mathematics numbered 300 or above.

Additional courses required as prerequisites for completion of the above include MATH 101 and 102, and 221.

HONORS: An Honors Program in physics is offered for qualified students; see the department head for details.

PHYS 100 (ENGN 100): Computing in Physics and Engineering (1)

Pass/Fail only. Prerequisite: Permission of the instructor. An introduction to the use of computing tools essential to degree work in physics and engineering. Students are instructed in the use of microcomputers, the university network, word processing, spreadsheets, computer algebra packages, and advanced symbolic mathematics tools. *Staff.*

Offered when interest is expressed and departmental resources permit.

PHYS 111: General Physics I (3)

Prerequisite or corequisite: MATH 101 or equivalent. An introduction to classical mechanics and thermodynamics. Topics include Newton's laws, wave motion, and the laws of thermodynamics. Under most circumstances, this course should be taken simultaneously with Physics 113. (SL, GEa: PHYS 113 is a corequisite for students seeking laboratory science credits.) *Staff.*

Fall

PHYS 112: General Physics II (3)

Prerequisite: PHYS 111. A continuation of PHYS 111. Topics include electricity and magnetism, optics, relativity, and quantum theory. Under most circumstances, this course should be taken simultaneously with PHYS 114. (SL, GEa: PHYS 114 is a corequisite for students seeking laboratory science credits.) *Staff.*

Winter

PHYS 113: General Physics Laboratory I (1)

Corequisite: PHYS 111. A laboratory course to accompany PHYS 111. Laboratory exercises in classical mechanics. (SL, GEa: see note above in PHYS 111.) *Staff.*

Fall

PHYS 114: General Physics Laboratory II (1)

Corequisite: PHYS 112. A laboratory course to accompany PHYS 112. Laboratory exercises in electricity and magnetism, optics, and modern physics. (SL, GEa: see note above in PHYS 112.) *Staff.*

Winter

PHYS 115: Apples and Anti-Apples: Physics for the Non-Scientist (3)

A conceptual overview of the fundamental ideas of modern physics. This non-laboratory course presents the essential concepts and philosophical and ethical aspects of the most important developments in modern physics, such as quantum mechanics, relativity, particle physics and statistical physics. Discusses the impact of these concepts on our continuous efforts to understand the universe. Algebra and geometry are used, but no calculus. (SC, GE5c) *I. Mazilu.*

Offered when interest Is expressed and departmental resources permit.

PHYS 150: The Immense Journey: *Harmonices Mundi* (4)

Prerequisite: Permission of the instructor. The classical astronomy of the solar system is traced by a study of Greek astronomy and the revolutionary ideas of Kepler and Newton. The apparent and real motions of the earth, moon, and planets are studied in detail, as well as special phenomena such as eclipses, tides, and objects such as comets and asteroids. Emphasis is on comprehension and application of principles rather than memorization of facts. The laboratory stresses the observational aspects of astronomy. Elementary geometry, algebra, and trigonometry are used in the course. Laboratory course. (SL, GE5a) *Boller.*

Fall

PHYS 151: Stellar Evolution and Cosmology (4)

Prerequisite: Permission of the instructor. An introduction to the physics and astronomy of stellar systems and the universe. Stellar evolution, the special and general theories of relativity and cosmology are studied. An assessment is made of the probabilities for life elsewhere in the universe. The feasibility of communication over interstellar distances also is investigated. Emphasis is on comprehension and application of principles rather than memorization of facts. The laboratory stresses the observational aspects of astronomy. Elementary geometry, algebra, and trigonometry are used in the course. Laboratory course. (SL, GE5a) *Sukow.*

Offered when interest is expressed and departmental resources permit.

PHYS 202: Relativity (3)

Prerequisites: PHYS 111 and 113. An examination of the special theory of relativity. Emphasis is placed on kinematic effects of the theory, conservation of momentum, conservation of energy, and electromagnetic implications of the theory. A brief introduction to general relativity is entertained. *D. Mazilu.*

Offered when interest Is expressed and departmental resources permit.

PHYS 207 (ENGN 207): Electrical Circuits (4)

Prerequisite: PHYS/ENGN 225. A detailed study of electrical circuits and the methods used in their analysis. Basic circuit components, as well as devices such as operational amplifiers, are investigated. The laboratory acquaints the student both with fundamental electronic diagnostic equipment and with the design and behavior of useful circuits. Laboratory course. *Sukow.*

Fall

PHYS 208 (ENGN 208): Electronics (4)

Prerequisite: PHYS/ENGN 207. An introduction to basic analog and digital electronics. Topics may include diodes, transistors, logic gates, flip-flops, counters and timers, and phase-locked loops. The integrated laboratory component of this course acquaints the student with the design of basic analog and digital circuits, and with the diagnostic techniques used to study these circuits. Laboratory course. *Staff.*

Offered when interest is expressed and departmental resources permit.

PHYS 210: Modern Physics (3)

Prerequisite: PHYS 112. An introduction to the physics of the atom, including the wave description of matter and quantum mechanics, and the experiments that led to the theory. Selected topics from atomic, molecular, nuclear, statistical, and solid state physics are discussed; the choice of topics may vary from year to year. *Sukow.*

Fall

PHYS 211: Experiments in Modern Physics (1)

Corequisite: PHYS 210. Some classic experiments of the 20th century are performed, including measurements of the charge-to-mass ratio of the electron, Planck's constant, and atomic spectra, as well as recent experiments in other areas of modern physics. *Staff.*

Fall

PHYS 215: Optics (4)

Prerequisites: PHYS 225 (ENGN 225). A study of the properties of electromagnetic waves with special emphasis on visible light. Wave descriptions are developed for scattering, reflection, refraction, interference, diffraction, and polarization. Topics in geometrical optics are also studied, including lenses and aberration theory. Laboratory course. *Sukow.*

Winter

PHYS 220: Electricity and Magnetism (3)

Prerequisites: PHYS 112 and 114; Prerequisite or corequisite: PHYS 225 (ENGN 225). An introduction to the classical theory of electric and magnetic fields. The basic equations of electromagnetism (Maxwell's equations) are developed through a study of electrostatics, steady-state magnetism, and electromagnetic induction. *D. Mazilu.*

Winter

PHYS 225 (ENGN 225): Mathematical Methods for Physics and Engineering (3)

Prerequisites: PHYS 112, MATH 221. Study of a collection of mathematical techniques particularly useful in upper-level courses in physics and engineering: vector differential operators such as gradient, divergence, and curl; functions of complex variables; Fourier analysis; orthogonal functions; matrix algebra and the matrix eigenvalue problem. *I. Mazilu.*

Winter

PHYS 230: Newtonian Mechanics (3)

Prerequisites: PHYS 111 and 113. A thorough study of Newton's laws of motion, rigid body motion, and accelerated reference frames. A student may not receive degree credit for both ENGN 204 and PHYS 230. *Boller.*

Winter

PHYS 240 (ENGN 240): Thermodynamics (3)

Prerequisites: PHYS 112 and MATH 221. A study of the fundamental concepts of thermodynamics, thermodynamic properties of matter, and applications to engineering processes. *Van Ness.*

Winter

PHYS 251 (ENGN 251): Experimental Methods in Physics and Engineering (3)

Prerequisite: PHYS 112 or permission of the instructor. An introduction to the design and implementation of experimental methods. Execution of the methods focuses on current data acquisition techniques, along with a study of standard data reduction and analysis. Results are examined in order to review the experimental method employed and to redesign the method for future experiments. This course is intended for any science major interested in performing experimental research on campus or in graduate school. *Kuehner.*

Fall

PHYS 255 (ENGN 255): C++ for Engineering and Physics (3)

Prerequisite: PHYS 112. An introduction to the C++ computing language, with applications characteristic of computation-intensive work in engineering and physics. Difference approximations to differential equations, stochastic methods, graphical presentation, and nonlinear dynamics are among the topics covered. Students need not have previous experience with C++. *Williams.*

Offered when interest is expressed and departmental resources permit.

PHYS 260 (ENGN 260): Materials Science (3)

Prerequisite: PHYS 112. An introduction to solid state materials. Study of the relation between microstructure and corresponding physical properties for metals, ceramics, polymers, and composites. *Van Ness.*

Winter

PHYS 315: Nuclear Physics (3)

Prerequisites: PHYS 210 and MATH 221. Topics include radioactivity, nuclear reactions, high-energy physics, and elementary particles. *Staff.*

Offered when interest is expressed and departmental resources permit.

PHYS 340: Quantum Mechanics (3)
Prerequisite: PHYS 210; Prerequisite or corequisite: MATH 332. The postulates on which quantum theory is based are introduced and illustrated through a series of examples, including photon polarization states (Mach-Zehnder interferometer); one-dimensional bound state (square well and harmonic oscillator) and scattering examples, (tunneling, resonant transmission) in the Schroedinger approach; and spin one-half systems (Bell inequality.) *Williams.*
Winter

PHYS 345: Statistical Physics (3)
Prerequisite: PHYS 340. A study of the statistical methods used in various branches of physics. The Fermi-Dirac and Bose-Einstein distribution functions are derived and applied to problems in thermodynamics and the physics of solids. *I. Mazilu.*
Fall

PHYS 361 (ENGN 361): Polymer Science and Engineering (3)
Prerequisite: PHYS/ENGN 240 or CHEM 261 or permission of the instructor. Science and engineering of large molecules. Physical and chemical structure of polymers correlated with mechanical properties. Crystal morphology. Theory of rubber elasticity. Time and temperature dependent properties of polymers. Relevance to polymer physics and chemical and mechanical engineering. *Van Ness.*
Offered when interest is expressed and departmental resources permit.

PHYS 401, 402, 403: Directed Individual Study (1,2,3)
Prerequisite: Permission of the instructor. Advanced work and reading in topics selected by the instructor to fit special needs of advanced students. This course may be repeated with permission for a total of six credits. *Staff.*

PHYS 421, 422, 423: Directed Individual Research (1,2,3)
Prerequisite: Permission of the instructor. Directed research in physics. May be repeated for degree credit with permission of the instructor. *Staff.*

PHYS 493: Honors Thesis (3-3)
Fall-Winter

POLITICS (POL)

PROFESSORS **RUSH**, CONNELLY, LEBLANC C. McCAUGHRIN, STRONG, VELÁSQUEZ
ASSOCIATE PROFESSORS, MOREL
ASSISTANT PROFESSORS DICKOVICK, HARRIS, ZARAKOL

MAJOR

A **major in politics** leading to a Bachelor of Arts degree requires completion of at least 41 credits as follows:

1. POL 100, 105, 111; ECON 101 and 102; INTR 201, 202
2. Five additional courses of 3 credits or more in politics, including completion of one of the following four sequences and including at least one 300-level seminar course which entails an independent research and writing component. All 300-level courses count towards the seminar requirement
   a. *General Study:* completion of five courses chosen from at least two of the three subfields below
   b. *American Government:* completion of four courses chosen from POL 229, 232, 234, 235, 236, 237, 250, 251 (SOC 251), 333, 360, 370, 397, 466 and at least one course chosen from the remaining 200- and 300-level courses in international/global politics or political philosophy
   c. *International/Global Politics:* completion of four courses chosen from POL 214, 215, 221, 227, 240, 245 (SOC 245), 246 (SOC 246), 247,255, 272 (SOC 272), 279, 327, 380, 381, 385, 392, 395 and at least one course chosen from the remaining 200- and 300-level courses in American government or political philosophy
   d. *Political Philosophy:* completion of four courses chosen from POL 265, 266, 360, 370, 396 and at least one course chosen from the remaining 200- and 300-level courses in international/global politics or American government
3. Six additional credits which must include courses from two of the following disciplines: anthropology, economics, history, philosophy, psychology, religion, or sociology

Honors: An Honors Program in politics is offered for qualified students. Politics majors who have at least a 3.500 grade-point average in the major and at least a 3.300 cumulative grade-point average at the end of their junior year qualify to write an honors thesis. Prospective honors candidates should contact the department head and potential thesis advisers in the fall of their junior year.

POL 100: American National Government (3)
A study of the constitutional origins and historical development of the national government with special attention to Congress, the presidency, the judiciary, and the role of political parties, interest groups, and the media in the policy process. (SS2, GE6b) *Staff.*
Fall, Winter