PHYSICAL EDUCATION 302 (2)—Care and Prevention of Athletic Injuries

Fundamentals of human anatomy, kinesiology, and physiology of exercise are studied. Prevention, care, and rehabilitation of injury techniques are analyzed. Discussion and instruction employing hydrotherapy, electrotherapy, and thermotherapy modalities are presented in the training room setting. Therapeutic exercise procedures are demonstrated and related to the overall program of athletic training. Practical lab work includes assignment to those intercollegiate teams whose sport is in season. *Jones.*

Winter

PHYSICAL EDUCATION 304 (2)—First Aid and Cardiopulmonary Resuscitation

A course designed to provide fundamental principles, knowledge, and skills in First Aid and CPR, leading to American Red Cross certification in Standard First Aid and Community CPR. (First class meeting mandatory.) *Staff.*

Fall, Winter, Spring

PHYSICAL EDUCATION 312 (1)—Lifeguard Training

A course designed to provide the fundamental principles and skills of lifeguarding, leading to American Red Cross certification. *Remillard.*

Winter

PHYSICAL EDUCATION 313 (2)—Water Safety Instructors' Course

Prerequisites: Permission of the instructor and either Physical Education 312 or valid American Red Cross certification in lifeguard training. A course designed to train and certify individuals to teach all levels of American Red Cross water safety courses. *Remillard.*

Spring

PHYSICS

(Department of Physics and Engineering)

McCormick Foundation

PROFESSORS WILLIAMS, AKINS, DONAGHY, NEWBOLT, REESE
ASSOCIATE PROFESSOR VAN NESS

MAJOR

A major in **physics** leading to either a Bachelor of Arts or a Bachelor of Science requires completion of 50 credits including the following:

1. Physics 108, 109, 210, 215, 220, 230, 240 (Engineering 240), 325, 340; and Mathematics 242, 332
2. One of the following laboratory courses: Computer Science 251; Engineering 207, 208, 251; Physics 207, 208
3. Ten credits chosen from among the following:
   Chemistry 111, 112 or those numbered 200 or above
   Computer Science 110, 111, or 130
   Engineering numbered 200 or above
   Mathematics numbered 300 or above
   Physics numbered 200 or above

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

Physics-Engineering major leading to a Bachelor of Science degree. The requirements for this program, which is designed for students interested in the field of physics-engineering, are described under Engineering.

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

PHYSICS 100 (Engineering 100) (1)—Computing in Physics and Engineering

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. *Akins and Williams.*

Fall

★PHYSICS 101 (4)—Natural Philosophy

The study of motion from Copernicus to Einstein. A brief look at the Copernican Revolution is followed by more detailed studies of Newtonian mechanics and Einstein's special theory of relativity. Some of the basic ideas of general relativity and the theory of elementary particles are discussed. Designed for non-science students wishing to satisfy the laboratory science general education requirement. Elementary algebra and geometry are used in the course. Not open to students who have successfully completed Physics 108. Laboratory course. *Donaghy.*

Fall

★PHYSICS 102 (3)—Natural Philosophy
The same as Physics 101 without the laboratory. Not open to students who have successfully completed Physics 108.
Fall

★PHYSICS 104 (Chemistry 104) (3)—The Conceptual Foundations of Quantum Theory
An introduction to what is currently the fundamental theory of nature. Quantum behavior is considered in the context of classical (Newtonian) notions of waves and particles and is applied to atomic, molecular, and nuclear systems. The practical and philosophical implications of quantum theory are examined in detail. No mathematics beyond high school algebra is assumed. *Desjardins and Williams.*
Winter

★PHYSICS 108 (4)—General Physics I
Corequisite: Mathematics 101. An introduction to classical mechanics and thermodynamics. Topics include Newton's laws, wave motion, and the laws of thermodynamics. Laboratory course. *Staff.*
Fall

★PHYSICS 109 (4)—General Physics II
Prerequisite: Physics 108. A continuation of Physics 108. Topics include electricity and magnetism, optics, relativity, and quantum theory. Laboratory course. *Staff.*
Winter

★PHYSICS 110 (3)—Energy and the Environment
A study of the basic principles underlying the conversion and use of energy. Topics include conservation of energy, the second law of thermodynamics, nuclear energy, solar energy, and the production and transmission of electrical energy. The effects on the environment of the various forms of energy are explored. (May not be used for credit in the interdepartmental major in the natural sciences and mathematics.) *Donaghy.*
Spring

★PHYSICS 150 (4)—The Immense Journey: Harmonices Mundi
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. (Can be used only as a cognate requirement for the interdepartmental major in natural sciences and mathematics.) Laboratory course. *Reese.*
Fall

★PHYSICS 151 (4)—Stellar Evolution and Cosmology
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 is also investigated. Emphasis also 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. (Can be used only as a cognate requirement for the interdepartmental major in natural sciences and mathematics.) Laboratory course. *Reese.*
Spring

PHYSICS 202 (3)—Relativity
Prerequisite: Physics 108. An examination of the special theory of relativity. Emphasis is placed on simple kinematic effects of the theory, the twin paradox, conservation of momentum, and conservation of energy. A brief introduction to four-vectors is presented and applied to simple electromagnetic problems. *Newbolt.*
Spring

PHYSICS 207 (Engineering 207) (4)—Electrical Circuits
Prerequisite: Physics 109. A detailed study of the methods used in the analysis of electrical circuits. The laboratory acquaints the student with fundamental electronic diagnostic equipment while investigating the behavior of basic circuit elements and devices such as operational amplifiers. Laboratory course. *Donaghy.*
Fall

PHYSICS 208 (Engineering 208) (4)—Electronics
(Offered when interest is expressed and departmental resources permit.) Prerequisite: Physics 109 and Physics/Engineering 207. An introduction to basic analog and digital electronics. The laboratory acquaints the student with the design of basic analog and digital circuits, and with the diagnostic techniques used to study these circuits. Laboratory course. *Donaghy.*

PHYSICS 210 (3)—Modern Physics
Prerequisite: Physics 109. An introduction to the physics of the present century. Emphasis is placed on quantification of the electromagnetic field (photons), the wave-particle duality, the hydrogen atom, electron spin, and other atomic and nuclear systems. *Newbolt.*
Fall

PHYSICS 215 (4)—Optics
Prerequisite: Physics 109. A study of the properties of electromagnetic waves with special emphasis on visible waves. Emphasis is given to the study of refraction, interference, diffraction, and polarization. Some emphasis is also given to quantum optics through the study of atomic spectra and the photoelectric effect. *Newbolt.*
Winter

PHYSICS 220 (3)—Electricity and Magnetism
Prerequisites: Physics 109; Mathematics 242. 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. *Donaghy.*
Winter

PHYSICS 230 (3)—Newtonian Mechanics
Prerequisite: Physics 108. 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 Engineering 204 and Physics 230. *Reese.*
Winter

PHYSICS 240 (Engineering 240) (3)—Thermodynamics
Prerequisites: Physics 109 and Mathematics 221. A study of the fundamental concepts of thermodynamics; thermodynamic properties of matter; and applications to engineering processes. *Van Ness.*
Winter

[PHYSICS 245 (3)—Statistical Physics]
(Offered when interest is expressed and departmental resources permit.) Prerequisite: Physics 210 or Physics/Engineering 240. A study of the statistical methods used in various branches of physics. The Fermi-Dirac and Bose-Einstein distribution functions will be derived and applied to problems in thermodynamics and the physics of solids. *Donaghy.*

[PHYSICS 315 (3)—Nuclear Physics]
(Offered when interest is expressed and departmental resources permit.) Prerequisites: Physics 210, Mathematics 221. Topics include radioactivity, nuclear reactions, high-energy physics, and elementary particles. *Donaghy.*

PHYSICS 325 (3)—Theoretical Physics
Prerequisites: Physics 220 and 230; Corequisite: Mathematics 242. A presentation of the Lagrangian and Hamiltonian formalisms of classical mechanics; time-dependent and relativistic electromagnetism; special mathematical methods of physics. *Williams.*
Fall

PHYSICS 340 (3)—Quantum Mechanics
Prerequisite: Physics 210; Corequisite: Mathematics 332. The Schrodinger wave formalism is established and applied to the harmonic oscillator, a particle in a square well, and the hydrogen atom. *Williams.*
Winter

[PHYSICS 360 (Engineering 360) (3)—Physical Metallurgy]
(Offered when interest is expressed and departmental resources permit.) Prerequisite: Physics/Engineering 240 or Chemistry 261 or permission of the instructor. An advanced discussion of structure-property relations of solid materials. Topics include phase equilibria for single and multi-component systems, diffusion, theory of dislocations, nucleation, solid solution theory, strengthening mechanisms for metals, alloys, elastic and plastic deformation. *Van Ness.*

PHYSICS 361 (Engineering 361) (3)—Polymer Science and Engineering
(Offered when interest is expressed and departmental resources permit.) Prerequisite: Physics/Engineering 240 or Chemistry 261 or permission of the instructor. Science and engineering of large molecules. Physical and chemical structure of polymers correlated with mechanical properties. Crystal morphology. Production and characterization. Chain statistics and rubber elasticity. Time and temperature dependent properties of polymers. Engineering applications. *Van Ness.*

PHYSICS 401 (1), 402 (2), 403 (3)—Directed Individual Study
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.*

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

PHYSICS 493 (3-3)—Honors Thesis
Fall-Winter