Nebraska Wesleyan University

Physics

Catalog

2012-2013

About the Program

The Bachelor of Arts degree is designed for those students who want a solid physics education with a broad liberal arts background and will be pursuing further education or employment in fields other than physics or engineering. The Bachelor of Science degree is designed for those students pursuing employment or further education in physics or engineering.

Physics Education major

See the Education Department on interdisciplinary majors in physical sciences and physics, natural sciences education, and applicable endorsements.

Dual-Degree Engineering Program

The Dual-Degree Program is a cooperative academic program between Nebraska Wesleyan University and The Fu Foundation School of Engineering and Applied Science at Columbia University in New York; The School of Engineering and Applied Science at Washington University in St. Louis; and the College of Engineering and Technology at the University of Nebraska. The Dual-Degree Program enables a student to devote three years to the study of sciences and liberal arts at Nebraska Wesleyan before transferring to one of these schools for two years of engineering studies. This program leads to a Bachelor of Science degree from Nebraska Wesleyan and the appropriate engineering bachelorâ??s degree from Columbia University, Washington University, or the University of Nebraska.

The Dual-Degree Program is designed to give the student the best of both liberal arts and engineering and to provide the practicing engineer with a background in the humanities and social sciences. The program encourages engineers to be aware of the changing values and priorities of society, and to be concerned about the effects of science and technology upon the environment and the quality of life.

Engineering fields of study include the following:

Columbia University

- Applied Mathematics
- Applied Physics
- Computer Engineering
- Computer Science
- Earth and Environmental Engineering
- Electrical Engineering
- Engineering Management Systems
- Engineering Mechanics
- Financial Engineering
- Industrial Engineering
- Materials Science and Engineering
- Mechanical Engineering
- Operations Research

Washington University

- Biomedical Engineering
- Chemical Engineering
- Computer Engineering
- Computer Science
- Electrical Engineering

- Mechanical Engineering
- System Science and Engineering

University of Nebraska

- Agricultural Engineering
- Architectural Engineering
- Biological Systems Engineering
- Chemical and Biomolecular Engineering
- Civil Engineering
- Computer Engineering
- Construction Engineering
- Construction Management
- Electrical Engineering
- Electronics Engineering
- Industrial Engineering
- Mechanical Engineering

Other information

In addition to the regular course offerings, the department provides opportunities to participate in research projects on an individual basis. These projects may be of a theoretical or experimental nature. The department is especially well equipped in digital electronics, atomic bean collisions, x-ray fluorescence spectroscopy, nuclear spectroscopy, health physics, and radiation protection.

Courses numbered below 100 are suitable for students who are not natural science majors. They may not be counted toward a major or minor in physics.

Majors, Minors & Degrees

Majors

1. Physics (B.A.)
2. Physics (B.S.)

Minors

1. Physics

Courses

NATSC 030 Introduction to Environmental Science

4 hours

An introduction to environmental science that provides an interconnected grounding in the natural sciences. Topics include energy, ecosystems, photosynthesis, biodiversity, population dynamics, air pollution, water pollution, radon/radioactivity, and hazardous waste. Laboratory activities, computer exercises, guest speakers, and multimedia presentations will also be a part of the course. When possible, the course will be team taught by faculty from at least two of the three natural science departments: Biology, Chemistry, and Physics.

Three lectures per week.

One 3-hour lab per week.

PHYS 010 Astronomy

4 hours

An introductory course on the solar system, stars and galaxies.

Three lectures per week.

One laboratory/observation per week.

Prerequisite(s): One year of high school algebra or permission of instructor.

(Normally offered each semester.)

PHYS 020 Introduction to Meteorology

4 hours

A survey of and explanation of weather and climate phenomena in terms of the physical characteristics and processes of the atmosphere.

Three lectures per week.

One laboratory per week.

Prerequisite(s): One year of high school algebra or permission of instructor.

PHYS 053 Earth Science

4 hours

A survey of geology and geophysics. Topics include characteristics of minerals and rocks, plate tectonics, Earth's interior, Earth history and time scales, surface processes, and ocean processes.

Three lectures per week.

One laboratory per week.

PHYS 054 Energy and the Global Environment

3 hours

A course covering some of the most critical problems facing the world today - those relating to the production, distribution, and use of energy. Text material may be supplemented with films, video tapes, and guest speakers.

Three lectures per week.

(Normally offered each spring semester.)

PHYS 055 Energy and the Global Environment Lab

1 hours

Laboratory experiments associated with PHYS 054 Energy and the Global Environment.
One laboratory per week.

Corequisite(s): PHYS 054 Energy and the Global Environment.

PHYS 100 Physics in Modern Society

1 hours

Applications of physics and technology and their impact on the individual, society, and the environment.

One hour of discussion/recitation per week.

Corequisite(s): PHYS 101 Principles of Physics I or PHYS 102 Principles of Physics II.

PHYS 101 Principles of Physics I

4 hours

The principles of classical mechanics, energy and motion designed for majors in the natural sciences. Algebra and trigonometry will be used in descriptions and problems.

Three 2-hour workshop sessions per week.

Corequisite(s): MATH 050 Pre-Calculus or permission of the instructor.

(Normally offered each fall semester.)

PHYS 102 Principles of Physics II

4 hours

A continuation of PHYS 101 Principles of Physics I with emphasis on waves, sound, electricity, magnetism, and electronics.

Three 2-hour workshop sessions per week.

Prerequisite(s): MATH 050 Pre-Calculus or permission of the instructor.

(Normally offered each spring semester.)

PHYS 111 General Physics I

4 hours

An introduction to classical mechanics, energy and motion designed for majors in the natural sciences. Elements of calculus will be used in descriptions and problems.

Three 2-hour workshop sessions per week.

Corequisite(s): MATH 060 Calculus for Management, Biological, and Social Sciences or MATH 105 Calculus I or permission of the instructor.

PHYS 112 General Physics II

4 hours

A continuation of PHYS 111 General Physics I with emphasis on waves, sound, electricity, magnetism, and electronics.

Three 2-hour workshop sessions per week.

Prerequisite(s): MATH 060 Calculus for Management, Biological, and Social Sciences or MATH 105 Calculus I; or permission of the instructor.

PHYS 121 Electronic Measurements

4-5 hours

An integrated treatment of analog and digital circuits and measurements using the techniques of solid state electronics and integrated circuits. Emphasis is placed on laboratory techniques.

Three lectures per week.

One or two laboratories per week.

Prerequisite(s): PHYS 102 Principles of Physics II or PHYS 112 General Physics II, and MATH 105 Calculus I.

(Normally offered each fall semester.)

PHYS 130 Computer Architecture and Interfacing

4 hours

A first course in the levels of architecture of a modern computer, from digital logic, through circuits and register level components, to programming. Topics include data representation, memory organization, input/output control, interfacing, and communication.

Three lectures per week.

One laboratory per week.

Prerequisite(s): PHYS 121 Electronic Measurements or CMPSC 040 Program Design or permission of the instructor.

PHYS 140 Introduction to Health Physics

4 hours

An introduction to health physics with emphasis on the practical aspects of radiation detection, protection, and regulation. Basic interaction of radiation with matter, biological effects of radiation, radiation dosimetry, and radiation protection regulations will be covered. Laboratory experience includes radiation spectroscopy, radiation dosimetry, environmental radiation monitoring, and radiation protection program design.

Three lectures per week.

One laboratory per week.

Prerequisite(s): PHYS 101 Principles of Physics I or PHYS 111 General Physics I or permission of the instructor.

PHYS 162 Introduction to Modern Physics

4-5 hours

An introduction to modern physics with emphasis on atomic and nuclear physics. Both analytical and experimental techniques will be used. Basic principles of physics and wave mechanics will be applied to atomic and nuclear models. The practical aspects of atomic and nuclear models. The practical aspects of atomic and nuclear radiation detection and safety will also be covered.

Three lectures per week.

One or two laboratories per week.

Prerequisite(s): PHYS 102 Principles of Physics II or PHYS 112 General Physics II, and MATH 106 Calculus II or permission of the instructor.

(Normally offered each spring semester.)

PHYS 190 Selected Topics

1-5 hours

A course designed to treat subject matter not covered in other departmental courses. The title, content, and credit hours will be determined by current mutual interests of faculty and students. This course may be offered to meet a requirement for a major only by approval of the department chair.

Prerequisite(s): To be determined by the instructor.

PHYS 209 Electromagnetic Theory

3 hours

A development of Maxwell's equations from basic principles with the object of achieving a macroscopic description of the electric and magnetic properties of matter, including a relativistic description of electromagnetic fields and their interaction with charged particles. Vector calculus is developed and used as needed.

Three lectures per week.

Prerequisite(s): PHYS 102 Principles of Physics II or PHYS 112 General Physics II, MATH 106 Calculus II, and computer programming skills or permission of the instructor.

Corequisite(s): MATH 204 Calculus III or MATH 224 Differential Equations or permission of the instructor.

PHYS 210 Optics

3 hours

The study of the production, transmission, diffraction, interference, refraction, polarization, and absorption of electromagnetic radiation.

Three lectures per week.

Prerequisite(s): PHYS 102 Principles of Physics II or PHYS 112 General Physics II, MATH 106 Calculus II, and computer programming skills or permission of the instructor.

Corequisite(s): MATH 204 Calculus III or MATH 224 Differential Equations or permission of the instructor.

PHYS 229 Mathematical Methods for Physics and Engineering

3 hours

Topics may include: Laplace transform and applications; series solution of differential equations, Bessel's equation, Legendre's equation, and special functions; matrices, eigenvalues and eigenfunctions; vector analysis and applications; boundary value programs and spectral representations; Fourier series and Fourier integrals; and solution of partial differential equations of mathematical physics.

Three lectures per week.

Prerequisite(s): MATH 224 Differential Equations or permission of the instructor.

PHYS 241 Classical Mechanics I

3 hours

A theoretical treatment of classical mechanics of particles and systems of particles with emphasis on the conservation laws of energy, momentum, and angular momentum. Particular topics in Newtonian, celestial, and continuum mechanics are studied. Vector calculus is developed and used as needed.

Three lectures per week.

Prerequisite(s): PHYS 101 Principles of Physics I or PHYS 111 General Physics I, MATH 106 Calculus II, and computer programming skills or permission of the instructor.

Corequisite(s): MATH 204 Calculus III or MATH 224 Differential Equations or permission of the instructor.

PHYS 242 Classical Mechanics II

3 hours

A continuation of PHYS 241 Classical Mechanics I involving the use of LaGrangian and Hamiltonian formalisms. Matrix methods are used in the study of rigid body motion, oscillation theory, and the theory of relativity. The mechanics of continuous media are also investigated.

Three lectures per week.

Prerequisite(s): PHYS 241 Classical Mechanics I and computer programming skills or permission of the instructor.

PHYS 251 Introduction to Quantum Physics I

3 hours

An introduction to quantum theory, statistical physics, and atomic spectra and properties.

Three lectures per week.

Prerequisite(s): PHYS 162 Introduction to Modern Physics, MATH 204 Calculus III or MATH 224 Differential Equations, and computer programming skills or permission of the instructor.

PHYS 252 Introduction to Quantum Physics II

3 hours

A continuation of PHYS 251 Introduction to Quantum Physics I that treats phenomena in atomic, molecular, nuclear, solid-state, and high-energy physics as applications of the principles of microscopic physics.

Three lectures per week.

Prerequisite(s): PHYS 251 Introduction to Quantum Physics I and computer programming skills or permission of the instructor.

PHYS 261 Thermal Physics

3 hours

A theoretical treatment of macrophysics. The basic principles of thermodynamics and kinetic theory, and statistical mechanics and information theory will be developed and applied to topics of current interest.

Three lectures per week.

Prerequisite(s): PHYS 101 Principles of Physics I or PHYS 111 General Physics I, MATH 106 Calculus II, and computer programming skills or permission of the instructor.

Corequisite(s): MATH 204 Calculus III or MATH 224 Differential Equations or permission of the instructor.

PHYS 262 Fluid Dynamics

3 hours

A theoretical treatment of nonrelativistic continuum fluid dynamics that emphasizes incompressible viscous flow phenomena, particularly those from within the field of geophysics.

Prerequisite(s): PHYS 101 Principles of Physics I or PHYS 111 General Physics I, MATH 106 Calculus II, and computer programming skills or permission of the instructor.

Corequisite(s): MATH 204 Calculus III or MATH 224 Differential Equations or permission of the instructor.

PHYS 281 Advanced Laboratory

1-2 hours

An advanced laboratory in which students extend and amplify the work of other courses. Work may be chosen in electrical measurements, physical optics, modern physics, or other areas of mutual interest.

Prerequisite(s): Permission of the instructor and approval of the department chair.

(Normally offered each semester.)

PHYS 290 Selected Topics

1-4 hours

A course designed to treat subject matter not covered in other departmental courses. The title, content, and credit hours will be determined by current mutual interests of faculty and students.

Prerequisite(s): Permission of the instructor and approval of the department chair.

PHYS 295 Independent Study

1-12 hours

Individual projects of a creative nature for qualified physics students. Projects may be of a theoretical or experimental nature. Independent study may not duplicate courses described in the catalog.

Prerequisite(s): Permission of the instructor and approval of the department chair.

PHYS 297 Physics Internship

1-8 hours

On-the-job training for physics majors in situations that satisfy the mutual interests of the student, the supervisor, and the instructor. The student will arrange for the position in accordance with the guidelines established by the department.

Pass/Fail only.

Prerequisite(s): Permission of the instructor and approval of the department chair.