Nebraska Wesleyan University

Physics, Astronomy, and Computer Science

Catalog

2016-2017

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.

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 bachelor'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
- Biomedical Engineering
- Chemical Engineering
- Civil Engineering
- Computer Engineering
- Computer Science
- Earth and Environmental Engineering
- Electrical Engineering
- Engineering Mechanics
- 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 Engineering
- Civil Engineering
- Computer Engineering
- Construction Engineering
- Construction Management
- Electrical Engineering
- Electronics 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, x-ray fluorescence and nuclear spectroscopy, astrophysics, and radiation protection.

Courses numbered below 1600 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

CMPSC 1000 Introduction to Computational Problem Solving

3 hours

An introduction to computational problem-solving using a programming language. Students learn the syntax and semantics of a language and apply these to the solution of mathematical problems. Students review mathematical concepts and use them as the basis of algorithmic solution during a hands-on lab. The course is recommended for all who wish to explore computer science.
Prerequisite(s): Math ACT score of at least 21 or permission of the instructor.
(Normally offered each fall semester.)

CMPSC 1500 Program Design

4 hours

A disciplined approach to the development of programs to solve problems on a computer. Topics include data types, control structures, abstraction, and software development. A lab component introduces a high-level programming language and software tools.
Corequisite(s): CMPSC 1000 Introduction to Computational Problem Solving or permission of the instructor.
(Normally offered each spring semester.)

CMPSC 2000 Data Structures

4 hours

A natural continuation of CMPSC 1500 Program Design concentrating on the motivation, design, implementation, and utilization of abstract data types. Topics include linked lists, stacks, queues, trees, and recursion. A lab component is incorporated.
Prerequisite(s): Grade of "C" or better in CMPSC 1500 Program Design.
(Normally offered alternate spring semesters.)

CMPSC 2600 Computer Architecture and Interfacing

4 hours

See PHYS 2600 Computer Architecture and Interfacing.

PHYS 1100 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.
Prerequisite(s): One year of high school algebra or permission of instructor.
(Normally offered alternate fall semesters.)

PHYS 1200 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. The basic concepts of heat, work, electricity and energy as they apply to energy use around the world will be studied. The major source of energy, their value and importance, the historical and future demand for energy and the specific environmental problems and benefits encountered will be identified.
Three lectures per week.
Prerequisite(s): One year of high school algebra or permission of instructor.
(Normally offered alternate spring semesters.)

PHYS 1200L Energy and the Global Environment Lab

1 hour

Laboratory experiments associated with PHYS 1200 Energy and the Global Environment.
One laboratory per week.
Corequisite(s): PHYS 1200 Energy and the Global Environment.

PHYS 1300 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 alternate spring semesters.)

PHYS 1400 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.
(Normally offered alternate fall semesters.)

PHYS 1500 Musical Acoustics

4 hours

The course includes a study of vibrating systems, waves and wave propagation, resonance, intensity and loudness levels of musical sounds, tone quality, frequency and pitch, interval scales, tuning and temperament. Room acoustics and the production of musical sounds by various musical instruments will be studied.
Three lectures per week.
One laboratory per week.

PHYS 1600 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 two-hour workshop sessions per week.
Students may not receive credit for both PHYS 1600 and PHYS 2000 General Physics I.
Corequisite(s): MATH 1100 College Algebra, and MATH 1470 Trigonometry or Math ACT of 27 or higher, or permission of the instructor.
(Normally offered each fall semester.)

PHYS 1700 Principles of Physics II

4 hours

A continuation of PHYS 1600 Principles of Physics I with emphasis on waves, sound, electricity, magnetism, and electronics.
Three two-hour workshop sessions per week.
Students may not receive credit for both PHYS 1700 and PHYS 2100 General Physics II.
Prerequisite(s): MATH 1100 College Algebra and MATH 1470 Trigonometry. Math ACT of 27 or higher, or permission of the instructor.
(Normally offered each spring semester.)

PHYS 1900 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 1950 Independent Study

1-4 hours

This is a research course. The student initially meets with the department chair to select a study topic and review research methods. At this time the student will be assigned a faculty resource person to guide his or her work and assist in an advisory capacity. A copy of the student's work is filed in the archives for the department. Independent study may not duplicate courses described in the catalog.
Prerequisite(s): Permission of the department chair.

PHYS 1960 Special Projects

1-15 hours

Supervised individual projects for students on topics selected by the student in consultation with the instructor. Special Projects may not duplicate courses described in the catalog.
Prerequisite(s): Permission of the instructor.

PHYS 1970 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.

PHYS 2000 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 two-hour workshop sessions per week.
Students may not receive credit for both PHYS 1600 Principles of Physics I and PHYS 2000.
Corequisite(s): MATH 1500 Calculus for Management, Biological, and Social Sciences or MATH 1600 Calculus I or permission of the instructor.
(Normally offered each fall semester.)

PHYS 2100 General Physics II

4 hours

A continuation of PHYS 2000 General Physics I with emphasis on waves, sound, electricity, magnetism, and electronics.
Three two-hour workshop sessions per week.
Students may not receive credit for both PHYS 1700 Principles of Physics II and PHYS 2100.
Prerequisite(s): MATH 1500 Calculus for Management, Biological, and Social Sciences or MATH 1600 Calculus I or permission of the instructor.
(Normally offered each spring semester.)

PHYS 2200 Electronic Measurements

4 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 laboratory per week.
Prerequisite(s): PHYS 1700 Principles of Physics II or PHYS 2100 General Physics II, and MATH 1600 Calculus I or permission of instructor.
(Normally offered each fall semester.)

PHYS 2400 Introduction to Modern Physics

4 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 laboratory per week.
Prerequisite(s): PHYS 1700 Principles of Physics II or PHYS 2100 General Physics II, and MATH 1610 Calculus II or permission of the instructor.
(Normally offered each spring semester.)

PHYS 2500 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 1700 Principles of Physics II or PHYS 2100 General Physics II or permission of the instructor.

PHYS 2600 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 2200 Electronic Measurements or CMPSC 1500 Program Design or permission of the instructor.
(Normally offered alternate spring semesters.)

PHYS 2700 Introduction to Astrophysics

4 hours

A quantitative treatment of topics in planetary science, stellar physics and cosmology, with emphasis on the interaction of matter and radiation.
Three lectures per week.
One laboratory per week.
Prerequisite(s): PHYS 1700 Principles of Physics II or PHYS 2100 General Physics II or permission of the instructor.

PHYS 2900 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 2950 Independent Study

1-4 hours

This is a research course. The student initially meets with the department chair to select a study topic and review research methods. At this time the student will be assigned a faculty resource person to guide his or her work and assist in an advisory capacity. A copy of the student's work is filed in the archives for the department. Independent study may not duplicate courses described in the catalog.
Prerequisite(s): Permission of the department chair.

PHYS 2960 Special Projects

1-15 hours

Supervised individual projects for students on topics selected by the student in consultation with the instructor. Special Projects may not duplicate courses described in the catalog.
Prerequisite(s): Permission of the instructor.

PHYS 2970 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.

PHYS 3000 Mechanics

4 hours

An advanced study of the mechanics of particles, systems of particles, and rigid bodies, with an emphasis on Newton's laws, conservation of energy, and conservation of linear and angular momentum. The behavior of moving, rotating, and oscillating systems will be studied, using both analytical and numerical approaches. Lagrangian and Hamiltonian formalisms will be introduced as complementary to Newtonian mechanics. Vector calculus will be developed and used as needed.
Three lectures per week.
One recitation per week.
Prerequisite(s): PHYS 1700 Principles of Physics II or PHYS 2100 General Physics II; MATH 1610 Calculus II and computer programming skills or permission of the instructor.
Corequisite(s): MATH 2600 Calculus III or MATH 3100 Differential Equations.
(Normally offered alternate fall semesters.)

PHYS 3100 Electromagnetism and Optics

4 hours

This course builds upon the foundation of electromagnetism and optics developed in introductory physics, and the quantum nature of photons introduced in modern physics. Topics include electrostatic forces, fields, and potentials; magnetic forces on charges and currents; magnetic fields produced by steady currents; light as an oscillating electromagnetic field; polarization of light; ray tracing of optical systems; optical interference; and electric, magnetic, and optical properties of matter. Vector calculus will be developed and heavily used.
Three lectures per week.
One recitation per week.
Prerequisite(s): PHYS 1700 Principles of Physics II or PHYS 2100 General Physics II; MATH 1610 Calculus II and computer programming skills or permission of the instructor.
Corequisite(s): MATH 2600 Calculus III or MATH 3100 Differential Equations.
(Normally offered alternate fall semesters.)

PHYS 3800 Advanced Laboratory

1-4 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 3900 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 3950 Independent Study

1-4 hours

Individual research 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 3960 Special Projects

1-15 hours

Supervised individual projects for students on topics selected by the student in consultation with the instructor. Special Projects may not duplicate courses described in the catalog.
Prerequisite(s): Permission of the instructor.

PHYS 3970 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.

PHYS 4000 Quantum and Atomic Physics

4 hours

An introduction to the Schrodinger equation and its solution. Topics studied include the 1D infinite square well, simple harmonic oscillator potential, and finite rectangular well/barrier, and the hydrogen atom, including the theory of angulary momentum. Theories of atomic scattering will also be explored.
Three lectures per week.
One recitation per week.
Prerequisite(s): PHYS 2400 Introduction to Modern Physics and MATH 2600 Calculus III or MATH 3100 Differential Equations and computer programming skills or permission of the instructor.
(Normally offered alternate spring semesters.)

PHYS 4100 Thermal and Statistical Physics

4 hours

An introduction to classical and statistical thermodynamics. Topics include the ideal gas equation of state, the First and Second Laws of Thermodynamics, the thermodynamic identity, engines and refrigerators, the thermodynamic potentials, and classical and quantum distribution functions. Vector calculus will be developed and heavily used.
Three lectures per week.
One recitation per week.
Prerequisite(s): PHYS 2400 Introduction to Modern Physics and MATH 2600 Calculus III or MATH 3100 Differential Equations and computer programming skills or permission of the instructor.
(Normally offered alternate spring semesters.)

PHYS 4900 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 4950 Independent Study

1-12 hours

Individual research 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 4960 Special Projects

1-15 hours

Supervised individual projects for students on topics selected by the student in consultation with the instructor. Special Projects may not duplicate courses described in the catalog.
Prerequisite(s): Permission of the instructor and approval of the department chair.

PHYS 4970 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.

PHYS 5200 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. The basic concepts of heat, work, electricity and energy as they apply to energy use around the world will be studied. The major source of energy, their value and importance, the historical and future demand for energy and the specific environmental problems and benefits encountered will be identified.
Three lectures per week.
One laboratory per week.

PHYS 5200L Energy and the Global Environment Lab

1 hour

Energy and the Global Environment Lab is the laboratory for PHYS 5200 Energy and the Global Environment.

PHYS 5900 Selected Topics: Physics

3 hours

This graduate-level course is designed to give students the opportunity for in-depth study of a physics-based concept. Topics will consist of a highly specialized area of study or revolve around issues or recent trends and innovations related to the field of physics.