

# PHYSICS

The objective of the study of Physics is for the student to acquire basic concepts and principles of physics, to become familiar with various types of physical processes and instrumentation, to develop a wide variety of problem-solving skills, and to acquire the ability to make critical decisions. The minor in Physics provides a core of fundamental physics courses which will enhance any math, science, or related field of study.

## Programs Minor

- Physics, Minor (<http://catalog.smsu.edu/academic-programs-degrees/physics/physics-minor/>)

## Faculty

Ken Murphy (<https://www.smsu.edu/directory/?d=employee&name=00013592#individualTables>)

## Undergraduate Courses

### PHYS 100 Our Physical Universe Credits: 3

A non-mathematical approach to the great ideas of physics and astronomy, together with their philosophical and social impact. This course is designed for non-science majors. Scientific topics include the developmental history of science, mechanics, electricity, magnetism, cosmology, relativity, quantum theory, and nuclear physics. Philosophical and social topics include methods and values of science, problems related to energy sources, and implications of modern weapons.

**Fall:** Department Discretion **Spring:** Department Discretion

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00000377/>)

### PHYS 100L Our Physical Universe Lab Credits: 1

A non-mathematical approach to the great ideas of physics and astronomy, together with their philosophical and social impact. This course is designed for non-science majors. Scientific topics include the developmental history of science, mechanics, electricity, magnetism, cosmology, relativity, quantum theory, and nuclear physics. Philosophical and social topics include methods and values of science, problems related to energy sources, and implications of modern weapons.

**Fall:** Department Discretion **Spring:** Department Discretion

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00001393/>)

### PHYS 120 Introductory Physics Credits: 3

A descriptive and experiential exploration of physics. Topics will be drawn from mechanics, waves, fluids, sound, heat, light, electricity, magnetism, and modern physics. The required preparation for this course is two years of high school mathematics or MATH 060.

**Goal:** Goal: 03- Natural Science

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00000378/>)

### PHYS 120L Introductory Physics Lab Credits: 1

A descriptive and experiential exploration of physics. Topics will be drawn from mechanics, waves, fluids, sound, heat, light, electricity, magnetism, and modern physics.

**Goal:** Goal: 03- Natural Science

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00001452/>)

### PHYS 121 Introduction to Astronomy Credits: 3

Qualitative introduction and historical outline of astronomy and development of physical laws used to describe the solar system, stars, galaxies, the universe, and some observational techniques. The laboratory includes extensive use of the planetarium.

**Goal:** Goal: 03- Natural Science

**Fall:** All Years

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00001390/>)

### PHYS 121L Introduction to Astronomy Lab Credits: 1

Qualitative introduction and historical outline of astronomy and development of physical laws used to describe the solar system, stars, galaxies, the universe, and some observational techniques. The laboratory includes extensive use of the planetarium.

**Goal:** Goal: 03- Natural Science

**Fall:** All Years

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00001391/>)

### PHYS 141 College Physics I Credits: 3

This is the first course in a two-semester sequence which makes extensive use of algebra and trigonometry covering fundamental concepts of physics. The sequence is appropriate for pre-professional majors requiring two semesters of physics. Includes basic principles of bodies at rest and in motion, periodic motion, heat, and thermodynamics. The required preparation for this course is three years of high school math including trigonometry or MATH 125.

**Goal:** Goal: 03- Natural Science

**Fall:** All Years

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00001605/>)

### PHYS 141L College Physics I Lab Credits: 1

Introductory physics course which makes extensive use of algebra and trigonometry. For students in the areas of biology, environmental science, health science and related pre-professional programs. Includes basic principles of bodies at rest and in motion, periodic motion, heat, thermodynamics, electricity, magnetism, electromagnetic radiation, optics, and selected topics from modern physics.

**Goal:** Goal: 03- Natural Science

**Fall:** All Years

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00001606/>)

### PHYS 142 College Physics II Credits: 3

This is the second course in a two-semester sequence which makes extensive use of algebra and trigonometry covering fundamental concepts of physics. The sequence is appropriate for pre-professional majors requiring two semesters of physics. Topics include electricity, magnetism, electromagnetic radiation, optics, and selected topics from modern physics.

**Pre-Requisite :** PHYS 141

**Spring:** All Years

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00001607/>)

**PHYS 142L College Physics II Lab Credits: 1**

Introductory physics course which makes extensive use of algebra and trigonometry. For students in the areas of biology, environmental science, health science and related pre-professional programs. Includes basic principles of bodies at rest and in motion, periodic motion, heat, thermodynamics, electricity, magnetism, electromagnetic radiation, optics, and selected topics from modern physics.

**Pre-Requisite :** PHYS 141

**Spring:** All Years

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00001608/>)

**PHYS 150 Directed Research Credits: 1-3**

Directed experimental and/or theoretical research on selected problems in the physical sciences.

**Fall:** Department Discretion **Spring:** Department Discretion

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00000382/>)

**PHYS 181 University Physics I Credits: 4**

This is the first course in a two-semester calculus level sequence covering fundamental concepts of physics. This is the preferred sequence for students majoring in physical science or engineering. Topics include Newtonian mechanics, conservation laws, simple harmonic motion, wave motion, and thermodynamics. Emphasizes the use of vectors and calculus in problem-solving.

**Goal:** Goal: 03- Natural Science

**Fall:** All Years

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00001601/>)

**PHYS 181L University Physics I Lab Credits: 1**

Introductory calculus-based physics course for students pursuing fields in engineering, physics, and chemistry. Topics include Newtonian mechanics, conservation laws, simple harmonic motion, wave motion, thermodynamics, electrostatics, simple DC/AC circuits, magnetism, electromagnetic waves, and optics. Emphasizes the use of vectors and calculus in problem-solving.

**Goal:** Goal: 03- Natural Science

**Fall:** All Years

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00001602/>)

**PHYS 182 University Physics II Credits: 4**

This is the second course in a two-semester calculus level sequence covering fundamental concepts of physics. This is the preferred sequence for students majoring in physical science or engineering. Topics include electrostatics, simple DC/AC circuits, magnetism, electromagnetic waves, and optics. Emphasizes the use of vectors and calculus in problem-solving.

**Pre-Requisite :** PHYS 181

**Spring:** All Years

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00001603/>)

**PHYS 182L University Physics II Lab Credits: 1**

Introductory calculus-based physics course for students pursuing fields in engineering, physics, and chemistry. Topics include Newtonian mechanics, conservation laws, simple harmonic motion, wave motion, thermodynamics, electrostatics, simple DC/AC circuits, magnetism, electromagnetic waves, and optics. Emphasizes the use of vectors and calculus in problem-solving.

**Pre-Requisite :** PHYS 181

**Spring:** All Years

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00001604/>)

**PHYS 186 Special Topics in Physics Credits: 1-4**

**Fall:** Department Discretion **Spring:** Department Discretion

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00002073/>)

**PHYS 241 Engineering Statics Credits: 3**

Applications of equations of equilibrium to the analysis of simple structures and machines. Use will be made of vector algebra, free body diagrams, center of gravity and moment of force acting on a rigid body.

**Fall:** Department Discretion **Spring:** Department Discretion

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00001590/>)

**PHYS 242 Engineering Dynamics Credits: 3**

Vector treatment of kinematics, Newtons Laws, work and energy, impulse and momentum with applications to problems of particle and rigid body motion.

**Fall:** Department Discretion **Spring:** Department Discretion

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00001591/>)

**PHYS 250 Directed Studies Credits: 1-3**

Directed study of selected topics in the physical sciences not covered elsewhere.

**Fall:** Department Discretion **Spring:** Department Discretion

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00000387/>)

**PHYS 260 Electronics Credits: 2**

Basic electricity and circuit functions, time-varying and resonant circuits, semiconductors (diodes, transistors and other devices), amplifiers, waveform generators, and nonlinear devices.

**Fall:** Department Discretion **Spring:** Department Discretion

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00001594/>)

**PHYS 260L Electronics Lab Credits: 1**

Basic electricity and circuit functions, time-varying and resonant circuits, semiconductors (diodes, transistors and other devices), amplifiers, waveform generators, and nonlinear devices.

**Fall:** Department Discretion **Spring:** Department Discretion

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00001593/>)

**PHYS 281L Analytical Physics I Lab Credits: 1**

**Fall:** Department Discretion **Spring:** Department Discretion

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00001455/>)

**PHYS 282L Analytical Physics II Lab Credits: 1**

Course requires science programmatic tuition of \$15.00 per credit

**Fall:** Department Discretion **Spring:** Department Discretion

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00001456/>)

**PHYS 286 Topics in Physics Credits: 1-4**

Study of physics topic not ordinarily covered in the established courses.

**Fall:** Department Discretion **Spring:** Department Discretion

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00001909/>)

**PHYS 290 Mathematical Physics Credits: 3**

A sequel to PHYS 182 designed for pre-engineers, some math majors, and other science majors. Emphasis will be placed upon a vector calculus treatment of the physical concepts of electromagnetism.

**Fall:** Department Discretion **Spring:** Department Discretion

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00001609/>)

**PHYS 291 Modern Physics Credits: 3**

A historically-based development of relativity and quantum theory as seen through the breakdown of classical physics. Investigation of the Bohr model of the atom, introduction to quantum mechanics and its application to problems involving simple forms of potential energy through the application of the Schrodinger equation. Brief introduction to topics including atomic, molecular, solid state, and nuclear physics.

**Fall:** Department Discretion **Spring:** Department Discretion

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00001610/>)

**PHYS 301 3D Modeling & Animation using Blender Credits: 1**

Students will use a free open source software package called Blender. Blender allows users to create three dimensional object models while adding materials, textures, and movement through key frame animation. Modeling techniques will include creating scene environments and adjusting lighting. Scenes will be animated and rendered into a final movie. Movies will be created in class using two camera projections: flat and fisheye for playing in the planetarium dome. Topics include Blender Interface, Modeling, Key frame Animation, Rendering for flat & fisheye cameras, Materials, Textures, Lighting, Modifiers, 3D Text, Blender Video Editor, Particles, Paths, Physics Simulator, Blender Game Engine Logic, legal sources of free models and music for making Productions. The recommended preparation is COMP 111 or the equivalent.

**Spring:** Department Discretion

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00149542/>)

**PHYS 351 Advanced Lab I Credits: 1**

Advanced physics lab for student majoring or minoring in physics. Lab experiments are derived from the areas of mechanics, thermodynamics, electricity and magnetism, optics, and modern physics.

**Fall:** Department Discretion **Spring:** Department Discretion

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00001595/>)

**PHYS 352 Advanced Lab II Credits: 1**

Advanced physics lab for student majoring or minoring in physics. Lab experiments are derived from the areas of mechanics, thermodynamics, electricity and magnetism, optics, and modern physics.

**Fall:** Department Discretion **Spring:** Department Discretion

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00001596/>)

**PHYS 391 Classical Mechanics Credits: 4**

Rigid bodies and systems of particles analyzed with Lagrangians, Hamiltonians, and methods from vector calculus, gravitation, central field problems, and wave motion.

**Fall:** Department Discretion **Spring:** Department Discretion

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00001630/>)

**PHYS 392 Electricity & Magnetism Credits: 4**

Electrostatics, magnetostatics, dielectrics, time varying electric and magnetic fields, electromagnetic induction, applications of Gauss Law, Amperes Law, and Faradays Law in the development of Maxwells equations.

**Fall:** Department Discretion **Spring:** Department Discretion

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00001629/>)

**PHYS 451 Advanced Lab III Credits: 1**

Advanced physics lab for student majoring or minoring in physics. Lab experiments are derived from the areas of mechanics, thermodynamics, electricity and magnetism, optics, and Modern Physics.

**Fall:** Department Discretion **Spring:** Department Discretion

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00001597/>)

**PHYS 452 Advanced Lab IV Credits: 1**

Advanced physics lab for student majoring or minoring in physics. Lab experiments are derived from the areas of mechanics, thermodynamics, electricity and magnetism, optics, and Modern Physics.

**Fall:** Department Discretion **Spring:** Department Discretion

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00001598/>)

**PHYS 480 Physics Seminar Credits: 1**

Presentations by students, faculty, and guest speakers covering research topics and issues relating to physics and/or engineering.

**Fall:** Department Discretion **Spring:** Department Discretion

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00001599/>)

**PHYS 486 Topics in Physics Credits: 1-4**

Study of physics topic not ordinarily covered in the established courses.

**Fall:** Department Discretion **Spring:** Department Discretion

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00001908/>)

**PHYS 491 Quantum Mechanics Credits: 4**

Basic principles of quantum mechanics including operators, one-dimensional wells and barriers, Schrodinger equation, uncertainty, wave-particle duality, Born interpretation, unstable states, bosons and fermions, central force problems, angular momentum, spin, addition of angular momentum, and various approximation methods.

**Fall:** Department Discretion **Spring:** Department Discretion

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00001628/>)

**PHYS 492 Thermal & Statistical Physics Credits: 4**

A rigorous analysis of the thermal properties of physical systems at the microscopic and macroscopic levels. Introduction to the laws of thermodynamics, cyclic processes, and entropy functions. Development of the Maxwell-Boltzmann, Bose-Einstein, and Fermi-Dirac distribution functions.

**Fall:** Department Discretion **Spring:** Department Discretion

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00001600/>)

**PHYS 499 Physics Internship Credits: 1-10**

Supervised work assignments in physics outside the University for selected and qualified students. Prior approval by the Physics Program of the project and of credit to be received is required.

**Fall:** Department Discretion **Spring:** Department Discretion

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00000399/>)

## Graduate Courses

**PHYS 589 Special Topics in Physics Credits: 1-4**

Advanced interdisciplinary study of the physical sciences. Intensive lectures, literature reviews, and discussions on fundamental and contemporary topics that have shaped and continue to shape our understanding of physical systems. Topics vary based on the interests of the students and the instructor.

**Fall:** Department Discretion **Spring:** Department Discretion **Summer**  
Department Discretion

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00194819/>)