

Students in any MSN concentration are eligible to complete the Clinical Nurse Specialist.

Department of Physics

Department of Physics

Physical Sciences Building, Room 119
(909) 537-5397 Department of Physics (<http://physics.csusb.edu>)

Bachelor of Arts

Physics

Bachelor of Science

- Physics
- Applied Physics

Minor

- Physics
- Applied Physics

Traditionally, physics majors have gone on to graduate work in physics, high school teaching, or employment in industrial or government laboratories. Other opportunities which have recently become interesting for physics graduates include atmospheric physics (including air pollution studies), geophysics, radiation safety, oceanography, astrophysics, technical administration, biophysics, computer science and medical instrumentation development.

The program for a bachelor of arts degree in physics provides basic knowledge in the main subject areas of physics as well as an opportunity for students to elect a considerable number of courses in other disciplines. This is a good choice for students planning careers in high school teaching. The bachelor of science program includes additional course work in physics and related fields which further prepares a student for employment or graduate work.

The Applied Physics option is designed to prepare students for direct employment in high-technology firms upon graduation. For traditional design tasks, high-technology firms typically hire applied physicists with a flexible and creative technical ability who can address a wide range of technical problems and develop an experimental system to attack problems. A solid understanding of theoretical physics across the curriculum is required and the ability to design, interface and control experimental apparatus. Because the tasks that applied physicists perform in the industrial environment are primarily experimental in nature, this option includes a number of laboratory courses in addition to the theory curriculum core: PHYS 150. Introductory Electronics; CSE 201. Computer Science I; PHYS 350. Data Acquisition and Control; PHYS 352. Advanced Electronics; and PHYS 430. Advanced Physics Laboratory. The courses in the applied physics option prepare students to function effectively in the computer-based experimental environment that they face in research and development, testing or process control.

Pre-engineering - The campus provides a pre-engineering program that enables students to complete the first two years of courses generic to engineering. Students may then transfer to an accredited engineering program of their choice. The following courses have been recommended as appropriate transfer courses:

CHEM 215	General Chemistry I: Atomic Structure and Chemical Bonding	6
CHEM 216	General Chemistry II: Principles of Chemical Reactions	6
MATH 211	Basic Concepts of Calculus	4
MATH 212	Calculus II	4
MATH 213	Calculus III	4
MATH 251	Multivariable Calculus I	4
MATH 252	Multivariable Calculus II	4
PHYS 221	General Physics I	5
PHYS 222	General Physics II	5
PHYS 223	General Physics III	5

Selected courses in computer science and general education

Students considering a physics or pre-engineering major should call the department office for advising.

Departmental Honors

To be awarded departmental honors in physics a student must:

1. Achieve at least a 3.5 minimum grade point average in courses required for the major taken at California State University, San Bernardino and at least a 3.0 grade point average overall;
2. Conduct advanced research on a topic approved by a faculty member who will serve as project director;
3. Obtain written approval upon successful completion of the project from the project director and the chair, and present the results of the research to the department or at a research conference, and/or publish the results in a peer-reviewed scientific journal.

Current Faculty

Paul K. Dixon, Professor, Chair
B.S. 1983, University of Michigan
M.A. 1985, Ph.D. 1990, University of Chicago

Carol Hood, Assistant Professor
Ph.D., University of California, Irvine, 2011

Karen Kolehmainen, Professor
B.S. 1977, Michigan State University
Ph.D. 1983, State University of New York at Stony Brook

Paul A. Renteln, Professor
B.A. 1981, University of California, Berkeley
Ph.D. 1988, Harvard University

Javier Torner, Professor, Director
B.S. 1978, J.P.M. Mexico
M.S. 1972, Ph.D. 1985, Illinois Institute of Technology

Timothy D. Usher, Professor
B.S. 1981, Appalachian State University
Ph.D. 1990, University of South Carolina

Laura M. Woodney, Associate Professor
B.A. 1993, John Hopkins University
M.S. 1997, Ph.D. 2000, University of Maryland

Emeritus

Leo P. Connolly, Professor

Undergraduate Degrees

Bachelor of Arts

- Physics (p. 650)

Bachelor of Science

- Physics (p. 650)
- Applied Physics (p. 651)

Minors

- Physics (p. 651)
- Applied Physics (p. 651)

Astronomy Courses

ASTR 103. Descriptive Astronomy. 5 Units.

(GE= B3)

A brief history of the development of astronomy followed by modern descriptions of our planetary system, stars, galaxies, models of the universe and the possibilities of life in the universe. Discussions of methods of extending knowledge of the universe. No previous background in natural sciences is required. Four hours lecture and three hours laboratory. Materials fee required. Formerly PHYS 103.

ASTR 311. A Cosmic Perspective of Earth. 5 Units.

Prerequisites: CHEM 100 and PHYS 100

Formation and evolution of the Earth, including its atmospheres, oceans and internal structure, placed in the context of our solar system. A comparative planetology course focusing on Earth and providing students with an understanding of where Earth fits into our solar system by introducing other solar system objects: planets, asteroids, comets, and moons alike. Fulfills the Earth and Space Science requirement for liberal studies. Four hours lecture and three hours laboratory. Materials fee required. May not count for credit towards the major or minor in Physics. Formerly PHYS 311.

Physics Courses

PHYS 100. Physics in the Modern World. 5 Units.

Prerequisites: completion of the general education requirement in mathematics, category B1

(GE=B3)

Examination of physics and its contemporary use, including topics of: mechanics, electricity, optics, sound, heat and radioactivity. This course is intended for students with little background in science. Four hours lecture and three hours laboratory. Materials fee required.

PHYS 121. Basic Concepts of Physics I. 5 Units.

Prerequisites: MATH 192 or 211, with a grade of C- or better (GE=B3)

First course of a three-course sequence surveying the basic concepts of physics, primarily for students entering fields relating to the biological sciences. This course will cover the basic principles of mechanics. Four hours lecture and three hours laboratory. Materials fee required.

PHYS 122. Basic Concepts of Physics II. 4 Units.

Prerequisites: PHYS 121

Continuation of PHYS 121. Topics include electricity, electric circuits and magnetism. Three hours lecture and three hours laboratory. Materials fee required.

PHYS 123. Basic Concepts of Physics III. 4 Units.

Prerequisites: PHYS 122

Continuation of PHYS 122. Topics include optics, waves and modern physics. Three hours lecture and three hours laboratory. Materials fee required.

PHYS 150. Introductory Electronics. 5 Units.

Prerequisites: a knowledge of trigonometry and exponential functions

Introduces electronics for the sciences and engineering. Assumes no experience in electronics and can be taken prior to introductory physics. Focus is on analog electronics: practical circuits, passive and active circuit elements, signal conditioning, test and measurement skills, and a brief introduction to digital electronics. Four hours lecture and three hours laboratory. Materials fee required.

PHYS 221. General Physics I. 5 Units.

Prerequisites: MATH 211

Prerequisite/Corequisite: MATH 212

(GE=B3)

First course of a five-course sequence in introductory physics for scientists and engineers. This sequence is intended for students with a strong background in mathematics and the sciences. Mechanics. Four hours lecture and three hours laboratory. Materials fee required.

PHYS 222. General Physics II. 5 Units.

Prerequisites: PHYS 221 and MATH 212. Recommended: MATH 213

Second course in a five-course sequence in introductory physics for scientists and engineers. Electromagnetism. Four hours lecture and three hours laboratory. Materials fee required.

PHYS 223. General Physics III. 5 Units.

Prerequisites: PHYS 222

Third course of a five-course sequence in introductory physics for scientists and engineers. Waves and optics. Four hours lecture and three hours laboratory. Materials fee required.

PHYS 224. General Physics IV. 3 Units.

Prerequisite/Corequisite: PHYS 223 or consent of instructor

Fourth course of a five-course sequence in introductory physics for scientists and engineers. An introduction to thermodynamics, kinetic theory and quantum mechanics. Three hours lecture.

PHYS 225. General Physics V. 3 Units.

Prerequisites: PHYS 224 or consent of instructor

Fifth course of a five-course sequence in introductory physics for scientists and engineers. An introduction to special relativity, the photon theory of electromagnetic radiation, atomic physics, nuclear physics, and elementary particle physics. Three hours lecture. Formerly PHYS 228.

PHYS 295A. Special Projects in Physics. 1 Unit.

Prerequisites: consent of instructor

Individual investigation, research, study or survey of selected problems. May be repeated for credit.

PHYS 295B. Special Projects in Physics. 2 Units.

Prerequisites: consent of instructor
Individual investigation, research, study or survey of selected problems.
May be repeated for credit.

PHYS 303. Astronomy for Educators. 3 Units.

An introductory course in the modern description of our planetary system, stars, galaxies, and models of the universe followed by basic principles and ideas in space science. Three hours lecture.

PHYS 304. Physics in the Classroom. 2 Units.

Prerequisites: one college level course in chemistry or earth science
Basic concepts of physics as related to the elementary and middle school classroom. Concepts include mechanics, electricity and magnetism, optics, thermodynamics, and modern physics. One hour lecture and three hours laboratory. Materials fee required.

PHYS 305. Demonstration Laboratory in Physics. 1 Unit.

Prerequisite/Corequisite: PHYS 304
A demonstration laboratory exploring the basic principles of physics through individual student demonstration. Three hours laboratory.
Materials fee required.

PHYS 306. Classical Mechanics I. 4 Units.

Prerequisites: PHYS 225 and one of the following: MATH 373, PHYS 373 with a grade of C or better in each course
A continuing study of dynamics with an introduction to advanced formulations. Four hours lecture.

PHYS 307. Classical Mechanics II. 4 Units.

Prerequisites: PHYS 306 with a grade of "C" or better
A continuation of PHYS 306 with emphasis in Lagrangian and Hamiltonian formulation in classical mechanics. Four hours lecture. Formerly PHYS 406.

PHYS 313. Electrodynamics I. 4 Units.

Prerequisites: PHYS 225 and 373 with a grade of "C" or better in each course
Derivation and applications of Maxwell's equations. Four hours lecture.

PHYS 314. Electrodynamics II. 4 Units.

Prerequisites: PHYS 313 with a grade of "C" or better
A continuation of PHYS 313 with advanced applications of Maxwell' equations and electromagnetic waves. Four hours lecture. Formerly PHYS 414.

PHYS 315. Introduction to Modern Optics. 4 Units.

Prerequisites: PHYS 313 with a grade of "C" or better
An introduction to geometrical optics, physical optics and lasers. Four hours lecture.

PHYS 318. Materials Science and Engineering. 4 Units.

Prerequisites: CHEM 215, PHYS 224 and PHYS 373
Fundamental materials science concepts with applications. Topics include structural, electrical and thermal properties of materials, phase diagrams, interfaces, and electronic band structure. Four hours lecture.

PHYS 324. Statistical and Thermal Physics. 4 Units.

Prerequisites: MATH 252 and PHYS 225 with a grade of "C" or better in each course
Basics of equilibrium thermodynamics including statistical description of physical systems, entropy and temperature, classical and quantum statistical ensembles, thermodynamics, and selected applications. Four hours lecture. Formerly PHYS 424.

PHYS 350. Data Acquisition and Control. 4 Units.

Prerequisites: CSE 201, PHYS 150 and PHYS 222
An introduction to computer-based data acquisition, control and analysis. Topics include instrument control, graphical programming, algorithm development, feedback control algorithms, and computer-based data analysis. Three hours lecture and three hours laboratory. Materials fee required.

PHYS 352. Advanced Electronics. 4 Units.

Prerequisites: PHYS 350 and PHYS 373 with a grade of "C" or better in each course
Advanced analog electronics techniques for science and engineering. Topics include computer-aided circuit design, high frequency techniques, modular circuit design, and computer-experiment interfacing. Three hours lecture and three hours laboratory. Materials fee required.

PHYS 370. Introduction to Astrophysics. 4 Units.

Prerequisites: PHYS 225 and 373 with a grade of "C" or better in each course
Basic principles of stellar structure and evolution, galactic structure, extragalactic astronomy and cosmology. Four hours lecture.

PHYS 373. Mathematical Methods of Physics I. 4 Units.

Prerequisites: PHYS 222 and MATH 252. MATH 331 is recommended
Vector calculus, Fourier analysis, and ordinary differential equations. Emphasis on techniques applicable to the problems of physics.

PHYS 398. Junior Assessment. 1 Unit.

Prerequisites: PHYS 306 and PHY 313 with a grade of "C" or better
Students will review the foundational subjects in physics (primarily classical mechanics, electrodynamics, thermodynamics and statistical mechanics, special relativity, and quantum mechanics) at the intermediate level and apply that knowledge to problem-solving.

PHYS 421. Quantum Mechanics I. 4 Units.

Prerequisites: MATH 331, PHYS 225 and PHYS 306 with a grade of "C" or better in each course
Introduction to quantum mechanics. Topics include the origins of quantum theory, angular momentum, the Dirac formalism, 2-level systems and the harmonic oscillator. Four hours lecture. Formerly PHYS 322.

PHYS 422. Quantum Mechanics II. 4 Units.

Prerequisites: PHYS 306, PHYS 314, and PHYS 421 with a grade of "C" or better in each course
Continued study of the principles of quantum mechanics introduced in PHYS 421. Topics include the axiomatic formulation of quantum mechanics, spin and orbital angular momentum, the Schrodinger equation in three dimensions, approximation methods, and scattering.

PHYS 430. Advanced Physics Laboratory. 4 Units.

Prerequisites: PHYS 313 with a grade of "C" or better. Recommended: PHYS 421

Selected advanced experiments appropriate to a student's previous preparation. May be repeated for credit. Two hours lecture and six hours laboratory. Materials fee required.

PHYS 450. Solid State Physics. 4 Units.

Prerequisites: PHYS 318, 421, and 473 with grades of "C" or better
A lecture course exploring selected topics in condensed matter physics. May be repeated for credit as topics change. Four hours lecture.

PHYS 461. Introduction to Nuclear Physics. 4 Units.

Prerequisites: PHYS 306 and 422 with a grade of "C" or better in each course
Basic concepts of nuclear structure and reactions, including accelerators and detectors, the nucleon-nucleon force, basic nuclear properties, the shell model, radioactivity, heavy ion reactions and quarks. Four hours lecture.

PHYS 463. Introduction to Elementary Particle Physics. 4 Units.

Prerequisites: PHYS 306 and 422 with a grade of "C" or better in each course
A survey of elementary particle physics, including accelerators, relativistic kinematics, conservation laws, quarks, the standard model, and quantum field theories. Four hours lecture.

PHYS 473. Mathematical Methods of Physics II. 4 Units.

Prerequisites: PHYS 373. MATH 331 and PHYS 225 are strongly recommended
A continuation of MATH/PHYS 373. Topics covered include functions of a complex variable and partial differential equations.

PHYS 480A. Topics in Classical Physics: Mechanics. 4 Units.

Prerequisites: PHYS 307 with a grade of "C" or better
Further treatment of topics in physics introduced in previous courses.

PHYS 480B. Topics in Classical Physics: Electrodynamics. 4 Units.

Prerequisites: PHYS 314 with a grade of "C" or better
Further treatment of topics in physics introduced in previous courses.

PHYS 485A. Topics in Contemporary Physics. 1 Unit.

A lecture course on a current topic or on new developments in physics. May be repeated for credit as topics change.

PHYS 485B. Topics in Contemporary Physics. 2 Units.

A lecture course on a current topic or on new developments in physics. May be repeated for credit as topics change.

PHYS 573. Mathematical Methods of Physics III. 4 Units.

Prerequisites: MATH 331, and MATH 473 or PHYS 473
A continuation of MATH/PHYS 473 with emphasis on advanced topics relevant to physics.

PHYS 585B. Internship in Physics. 2 Units.

Prerequisites: consent of instructor and department
Supervised work and study in physics in private or public setting. May be repeated for up to six units of credit. Graded credit/no credit.

PHYS 585C. Internship in Physics. 3 Units.

Prerequisites: consent of instructor and department
Supervised work and study in physics in private or public setting. May be repeated for up to six units of credit. Graded credit/no credit.

PHYS 585D. Internship in Physics. 4 Units.

Prerequisites: consent of instructor and department
Supervised work and study in physics in private or public setting. May be repeated for up to six units of credit. Graded credit/no credit.

PHYS 590. Physics Seminar. 1 Unit.

Prerequisites: senior standing and consent of department
Provides a vehicle for assessing the subject matter competency of physics graduates. May be repeated for credit. A total of two units may be applied towards the major requirements for graduation. Lecture only.

PHYS 595A. Independent Study. 1 Unit.

Prerequisites: a minimum overall grade point average of 3.0, consent of instructor and departmental approval of a written proposal of a project submitted on a standard application filed in advance of the quarter in which the course is to be taken
Research in physics conducted under the direction of a faculty member. A total of six units in PHYS 595 may be applied toward graduation.

PHYS 595B. Independent Study. 2 Units.

Prerequisites: a minimum overall grade point average of 3.0, consent of instructor and departmental approval of a written proposal of a project submitted on a standard application filed in advance of the quarter in which the course is to be taken
Research in physics conducted under the direction of a faculty member. A total of six units in PHYS 595 may be applied toward graduation.

PHYS 595C. Independent Study. 3 Units.

Prerequisites: a minimum overall grade point average of 3.0, consent of instructor and departmental approval of a written proposal of a project submitted on a standard application filed in advance of the quarter in which the course is to be taken
Research in physics conducted under the direction of a faculty member. A total of six units in PHYS 595 may be applied toward graduation.

PHYS 595D. Independent Study. 4 Units.

Prerequisites: a minimum overall grade point average of 3.0, consent of instructor and departmental approval of a written proposal of a project submitted on a standard application filed in advance of the quarter in which the course is to be taken
Research in physics conducted under the direction of a faculty member. A total of six units in PHYS 595 may be applied toward graduation.

PHYS 595E. Independent Study. 5 Units.

Prerequisites: a minimum overall grade point average of 3.0, consent of instructor and departmental approval of a written proposal of a project submitted on a standard application filed in advance of the quarter in which the course is to be taken
Research in physics conducted under the direction of a faculty member. A total of six units in PHYS 595 may be applied toward graduation.

PHYS 595F. Independent Study. 6 Units.

Prerequisites: a minimum overall grade point average of 3.0, consent of instructor and departmental approval of a written proposal of a project submitted on a standard application filed in advance of the quarter in which the course is to be taken

Research in physics conducted under the direction of a faculty member. A total of six units in PHYS 595 may be applied toward graduation.

PHYS 999. Comprehensive Examination. 0 Units.

Prerequisites: advancement to candidacy, approval of department, completion of course work in the masters program, and in good academic standing

An assessment of the students ability to integrate the knowledge of the area, show critical and independent thinking and demonstrate mastery of the subject matter.

Bachelor of Arts in Physics

Requirements (89 units)

Total units required for graduation: 180

Requirements for the B.A. in Physics**Lower-division requirements (53)**

CHEM 215	General Chemistry I: Atomic Structure and Chemical Bonding	6
CHEM 216	General Chemistry II: Principles of Chemical Reactions	6
MATH 211	Basic Concepts of Calculus	4
MATH 212	Calculus II	4
MATH 213	Calculus III	4
MATH 251	Multivariable Calculus I	4
MATH 252	Multivariable Calculus II	4
PHYS 221	General Physics I	5
PHYS 222	General Physics II	5
PHYS 223	General Physics III	5
PHYS 224	General Physics IV	3
PHYS 225	General Physics V	3

Upper-division requirements (29)

MATH 331	Linear Algebra	4
PHYS 306	Classical Mechanics I	4
PHYS 313	Electrodynamics I	4
PHYS 324	Statistical and Thermal Physics	4
PHYS 373	Mathematical Methods of Physics I	4
PHYS 398	Junior Assessment	1
PHYS 421	Quantum Mechanics I	4
PHYS 430	Advanced Physics Laboratory	4

Electives (7)

Seven units chosen from upper-division physics courses selected with the approval of the department: 7

PHYS 307	Classical Mechanics II
PHYS 314	Electrodynamics II
PHYS 315	Introduction to Modern Optics
PHYS 318	Materials Science and Engineering
PHYS 370	Introduction to Astrophysics

PHYS 422	Quantum Mechanics II
PHYS 450	Solid State Physics
PHYS 461	Introduction to Nuclear Physics
PHYS 463	Introduction to Elementary Particle Physics
PHYS 473	Mathematical Methods of Physics II
PHYS 480A	Topics in Classical Physics: Mechanics
PHYS 480B	Topics in Classical Physics: Electrodynamics
PHYS 485A-D	Topics in Contemporary Physics
PHYS 573	Mathematical Methods of Physics III
PHYS 590	Physics Seminar
PHYS 595A-E	Independent Study

Total Units 89

Bachelor of Science in Physics

Requirements (107 units)

Total units required for graduation: 180

Requirements for the B.S. in Physics**Lower-division requirements (53)**

CHEM 215	General Chemistry I: Atomic Structure and Chemical Bonding	6
CHEM 216	General Chemistry II: Principles of Chemical Reactions	6
MATH 211	Basic Concepts of Calculus	4
MATH 212	Calculus II	4
MATH 213	Calculus III	4
MATH 251	Multivariable Calculus I	4
MATH 252	Multivariable Calculus II	4
PHYS 221	General Physics I	5
PHYS 222	General Physics II	5
PHYS 223	General Physics III	5
PHYS 224	General Physics IV	3
PHYS 225	General Physics V	3

Upper-division requirements (45)

MATH 331	Linear Algebra	4
PHYS 306	Classical Mechanics I	4
PHYS 307	Classical Mechanics II	4
PHYS 313	Electrodynamics I	4
PHYS 314	Electrodynamics II	4
PHYS 324	Statistical and Thermal Physics	4
PHYS 373	Mathematical Methods of Physics I	4
PHYS 398	Junior Assessment	1
PHYS 421	Quantum Mechanics I	4
PHYS 422	Quantum Mechanics II	4
PHYS 430	Advanced Physics Laboratory	4
PHYS 473	Mathematical Methods of Physics II	4

Electives (9)

five or more units chosen from upper-division physics courses selected with the approval of the department: 5

PHYS 315	Introduction to Modern Optics
PHYS 318	Materials Science and Engineering

PHYS 370	Introduction to Astrophysics	
PHYS 450	Solid State Physics	
PHYS 461	Introduction to Nuclear Physics	
PHYS 463	Introduction to Elementary Particle Physics	
PHYS 480A	Topics in Classical Physics: Mechanics	
PHYS 480B	Topics in Classical Physics: Electrodynamics	
PHYS 485A-D	Topics in Contemporary Physics	
PHYS 573	Mathematical Methods of Physics III	
PHYS 590	Physics Seminar	
PHYS 595A-E	Independent Study	
Four units of computer science course work at the 200-level or above selected with the approval of the Physics Department.		4
Total Units		107

Bachelor of Science in Physics - Applied Physics

Requirements (107 units)

Total units required for graduation: 180

Requirements for the B.S. in Physics - Applied Physics Option

Lower-division requirements (62)

CHEM 215	General Chemistry I: Atomic Structure and Chemical Bonding	6
CHEM 216	General Chemistry II: Principles of Chemical Reactions	6
CSE 201	Computer Science I	4
MATH 211	Basic Concepts of Calculus	4
MATH 212	Calculus II	4
MATH 213	Calculus III	4
MATH 251	Multivariable Calculus I	4
MATH 252	Multivariable Calculus II	4
PHYS 150	Introductory Electronics	5
PHYS 221	General Physics I	5
PHYS 222	General Physics II	5
PHYS 223	General Physics III	5
PHYS 224	General Physics IV	3
PHYS 225	General Physics V	3

Upper-division requirements (45)

MATH 331	Linear Algebra	4
PHYS 306	Classical Mechanics I	4
PHYS 313	Electrodynamics I	4
PHYS 314	Electrodynamics II	4
PHYS 318	Materials Science and Engineering	4
PHYS 324	Statistical and Thermal Physics	4
PHYS 350	Data Acquisition and Control	4
PHYS 352	Advanced Electronics	4
PHYS 373	Mathematical Methods of Physics I	4
PHYS 398	Junior Assessment	1
PHYS 421	Quantum Mechanics I	4

PHYS 430	Advanced Physics Laboratory	4
Total Units		107

Minor in Applied Physics

Requirements (54 units)

Requirements for a minor in Applied Physics

Lower-division requirements (42)

CSE 201	Computer Science I	4
MATH 211	Basic Concepts of Calculus	4
MATH 212	Calculus II	4
MATH 251	Multivariable Calculus I	4
PHYS 150	Introductory Electronics	5
PHYS 221	General Physics I	5
PHYS 222	General Physics II	5
PHYS 223	General Physics III	5
PHYS 224	General Physics IV	3
PHYS 225	General Physics V	3

Upper-division requirements (12)

PHYS 350	Data Acquisition and Control	4
PHYS 352	Advanced Electronics	4
PHYS 373	Mathematical Methods of Physics I *	4
Total Units		54

* **Note:** The MATH 252 prerequisite for PHYS 373 will be waived for the applied physics minor.

Minor in Physics

Requirements (61 units)

Requirements for a minor in Physics

Lower-division requirements (41)

MATH 211	Basic Concepts of Calculus	4
MATH 212	Calculus II	4
MATH 213	Calculus III	4
MATH 251	Multivariable Calculus I	4
MATH 252	Multivariable Calculus II	4
PHYS 221	General Physics I	5
PHYS 222	General Physics II	5
PHYS 223	General Physics III	5
PHYS 224	General Physics IV	3
PHYS 225	General Physics V	3

Upper-division requirements (20)

PHYS 306	Classical Mechanics I	4
PHYS 313	Electrodynamics I	4
PHYS 324	Statistical and Thermal Physics	4
PHYS 373	Mathematical Methods of Physics I	4
PHYS 421	Quantum Mechanics I	4

Total Units		61
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