



Program

BS in Physics

Option in General Physics

Option in Professional Physics

Advanced Study Pattern

Applied Physics Pattern

Minor in Physics

Single Subject Teaching

Credential in Science

“Look deep into nature, then you will understand everything better.” —*Albert Einstein (1879–1955)*

The Department of Physics offers the Bachelor of Science Degree in Physics with the choice of two options. The department also offers a minor in physics.

The Option in Professional Physics has two advising patterns. The Advanced Study pattern is the traditional B.S. program designed to prepare students for graduate study or for professional careers in government or industry. The Applied Physics pattern is designed to prepare students for careers in technical fields, such as optics, electronics or materials science.

The Option in General Physics is designed to prepare students for teaching secondary school physics, with additional subject matter breadth across all sciences. This option fulfills all requirements for the Single Subject Teaching Credential in Science with a Concentration in Physics and a supplementary authorization in a second science. This option is also for students who are interested in physics-related interdisciplinary fields such as biophysics, geophysics, atmospheric sciences, physical oceanography, health physics, or environmental science.

The physics minor greatly strengthens the preparation of students majoring in mathematics, engineering, computer science, chemistry, geosciences, biology, and other fields

of science or technology. It is particularly important for students who intend to pursue graduate studies in physical chemistry, geophysics, biophysics, or medical physics.

Students in such fields as mathematics, chemistry, engineering, or computer science may wish to consider physics as a second major. These fields are very compatible with physics, and some course work will satisfy the requirements for both majors.

Facilities

Special facilities available include laboratories for modern optics, X-ray diffraction and fluorescence, gamma ray spectroscopy, superconductivity, and nuclear physics.

Career Outlook

While graduate work is necessary for entry into some physics-related careers, physicists with the baccalaureate enjoy excellent employment opportunities in a wide variety of areas including optics and telecommunications, space, defense, energy, and environmental science.

Physicists are also employed in research and development projects involving electronic systems and devices, optics, computers, nuclear reactors, microwaves, and vacuum systems. Others find employment in such diverse fields as criminal investigation or public health.

There is a huge demand for high school science teachers. The Option in General Physics is the ideal preparation for such a career.

In addition to consulting faculty, students with career-related questions are encouraged to visit the Offices of Advising and Orientation, and Counseling and Career Planning. These offices provide assistance with exploration of life goals, academic and career planning, and information on occupations related to majors as well as job market and placement trends.

Physics

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Chair: Chris Gaffney

Undergraduate Advisor: Chris Gaffney
Credential Advisor: Chris Gaffney

The Bachelor of Science in Physics

Total Course Requirements for the Bachelor's Degree: 120 units

See "Requirements for the Bachelor's Degree" in the *University Catalog* for complete details on general degree requirements. A minimum of 40 units, including those required for the major, must be upper division.

A suggested Major Academic Plan (MAP) has been prepared to help students meet all graduation requirements within four years. Please request a plan from your major advisor or view it and other current advising information at <http://em.csuchico.edu/aap/ProgramSearch>.

General Education Requirements: 48 units

See "General Education Requirements" in the *University Catalog* and the *Class Schedule* for the most current information on General Education Requirements and course offerings. The course requirements marked below with an asterisk (*) may also be applied toward General Education.

Physics majors may meet the Breadth Area B2 requirement by completing BIOL 151.

Option in General Physics

HIST 130 may be used to fulfill Breadth Area C1, C2, or C3 requirements; POLS 155 may be used to fulfill any one of the Breadth Area D1, D2, or D3 requirements; and HCSV 451 may be used to fulfill Area E requirements.

Diversity Course Requirements: 6 units

See "Diversity Requirement" in the *University Catalog*. Most courses taken to satisfy these requirements may also apply to General Education.

U.S. History, Constitution, and American Ideals: 6 units

See "U.S. History, Constitution, and American Ideals" under "Bachelor's Degree Requirements". This requirement is normally fulfilled by completing HIST 130 and POLS 155 or approved equivalents. Courses used to satisfy this requirement do not apply to General Education.

Literacy Requirement:

See "Mathematics and Writing Requirements" in the *University Catalog*. Writing proficiency in the major is a graduation requirement and may be demonstrated through satisfactory completion of a course in your major which has been designated as the Writing Proficiency (WP) course for the semester in which you take the course. Students who earn below a C- are required to repeat the course and earn a C- or better to receive WP credit. See the *Class Schedule* for the designated WP courses for each semester. You must pass ENGL 130 (or its equivalent) with a C- or better before you may register for a WP course.

Course Requirements for the Major: 70-81 units

Completion of the following courses, or their approved transfer equivalents, are required of all candidates for this degree.

Major Core Program: 46 units

Lower-Division Requirements: 36 units

9 courses required:

CHEM 111	General Chemistry	4.0	FS *
Prerequisites: Second-year high school algebra; one year high school chemistry. (One year of high school physics and one year of high school mathematics past Algebra II are recommended.)			
CHEM 112	General Chemistry	4.0	FS
Prerequisites: CHEM 111 with a grade of C- or higher.			
MATH 120	Analytic Geometry and Calculus	4.0	FS *
Prerequisites: Completion of ELM requirement; both MATH 118 and MATH 119 (or high school equivalent); a score that meets department guidelines on a department administered calculus readiness exam.			
MATH 121	Analytic Geometry and Calculus	4.0	FS
Prerequisites: MATH 120.			
MATH 220	Analytic Geometry and Calculus	4.0	FS
Prerequisites: MATH 121.			
MATH 260	Elem Differential Equations	4.0	FS
Prerequisites: MATH 121.			
PHYS 204A	Mechanics	4.0	FS *
Prerequisites: High school physics or faculty permission. Concurrent enrollment in or prior completion of MATH 121 (second semester of calculus) or equivalent.			
PHYS 204B	Electricity and Magnetism	4.0	FS
Prerequisites: MATH 121, PHYS 204A with a grade of C- or higher.			
PHYS 204C	Heat/Wave Motion/Sound/Light	4.0	FS
Prerequisites: MATH 121, PHYS 204A with a grade of C- or higher.			

Upper-Division Requirements: 10 units

4 courses required:

PHYS 300A	Modern Physics I	3.0	FA
Prerequisites: PHYS 204A, PHYS 204B, PHYS 204C, or PHYS 202A and PHYS 202B and calculus with faculty permission.			
PHYS 300B	Modern Physics II	3.0	SP
Prerequisites: PHYS 300A.			

PHYS 427	Advanced Laboratory	3.0	FA	WP
Prerequisites: ENGL 130 (or its equivalent) with a grade of C- or higher, PHYS 300B.				
PHYS 491	Physics Seminar	1.0	SP	
Prerequisites: Upper-division standing in physics.				

Major Option Course Requirements: 24-35 units

The following courses, or their approved transfer equivalents, are required dependent upon the option chosen. Students must select one of the following options for completion of the major course requirements.

The Option in Professional Physics: 24-25 units

This option is for students who intend to pursue graduate study in physics or related fields or who plan to enter careers in technical fields.

Option Core: 9 units

3 courses required:

MATH 361	Boundary Value/Partial Dif Eqs	3.0	FA
Prerequisites: MATH 260.			
PHYS 301A	Analytical Mechanics	3.0	F1
Prerequisites: MATH 260, PHYS 204A, PHYS 204B, PHYS 204C.			
PHYS 302A	Electricity and Magnetism	3.0	F2
Prerequisites: MATH 260, PHYS 204A, PHYS 204B, PHYS 204C.			

Advising Pattern Course Requirements: 15-16 units

The following courses, or their approved transfer equivalents, are required dependent upon the advising pattern chosen. Students must select one of the following advising patterns to complete the Option in Professional Physics and major course requirements.

Advanced Study Pattern: 15 units

This option pattern is for students intending to pursue graduate study in physics or related fields. This is also suited to many technical careers.

5 courses required:

PHYS 301B	Analytical Mechanics	3.0	S2
Prerequisites: PHYS 301A.			
PHYS 302B	Electricity and Magnetism	3.0	S1
Prerequisites: PHYS 302A or faculty permission.			
PHYS 415	Thermal Physics	3.0	S2
Prerequisites: MATH 361, PHYS 300A.			
PHYS 435A	Quantum Mechanics	3.0	FA
Prerequisites: MATH 361, PHYS 300A.			
PHYS 435B	Quantum Mechanics	3.0	SP
Prerequisites: PHYS 435A.			

Applied Physics Pattern: 16 units

This option pattern is for students intending to pursue careers in applied physics, optics, telecommunications, or related fields.

6 courses required:

MECH 210	Materials Science/Engineering	3.0	FS
Prerequisites: PHYS 204A; CHEM 111.			
EECE 211	Linear Circuits I	3.0	FS
Prerequisites: MATH 121, PHYS 204B.			
EECE 211L	Linear Circuits I Activity	1.0	FS
Corequisites: EECE 211.			
PHYS 312	Computer-Asst Problem-Solving	3.0	SP
Prerequisites: PHYS 300A. No previous computer experience necessary.			
PHYS 450	Optics	3.0	SP
Prerequisites: PHYS 204A, PHYS 204B, PHYS 204C.			
This course is also offered as EECE 450.			
PHYS 451	Lasers and Their Applications	3.0	FA
Prerequisites: PHYS 204C. Recommended: EECE 450 or PHYS 450.			
This course is also offered as EECE 451.			

The Option in General Physics: 35 units

This option fulfills all requirements for the Single Subject Teaching Credential in Science with a Concentration in Physics and a supplementary authorization in a second science. This option is also excellent preparation for students considering physics-related interdisciplinary fields. Students who choose this option should consult with their major advisor.

5 courses required:

BIOL 151	Prin of Cell and Molec Biology	4.0	FS	
Prerequisites: Recommend CHEM 111 or concurrent enrollment.				
BIOL 152	Prin Ecol, Evol, Org Biology	4.0	SP	
Prerequisites: BIOL 151 or faculty permission; recommend CHEM 112 or concurrent enrollment.				
GEOS 102	Physical Geology	3.0	FS *	
Prerequisites: High school chemistry or physics is recommended; students with no previous science courses are advised to enroll in GEOS 101. No college credit for those who have passed GEOS 101.				
GEOS 300	Earth System Science	3.0	FA	WP
Prerequisites: ENGL 130 (or its equivalent) with a grade of C- or higher; CHEM 107 or CHEM 111; PHYS 202A, PHYS 202B or PHYS 204A, PHYS 204B or PHYS 204C.				
PHYS 489T	Internship in Physics Teaching	3.0	FS	
Prerequisites: PHYS 300B and faculty permission.				

6 units required:

Any upper-division course in physics (except PHYS 489P and PHYS 489T) with approval of the credential advisor.

Breadth Requirements: 12 units

12 units required:

Any non-General Education courses in Chemistry (CHEM), Biology (BIOL), or Geoscience (GEOS). All 12 units must be selected from one department.

Electives Requirement:

To complete the total units required for the bachelor's degree, select additional elective courses from the total University offerings. You should consult with an advisor regarding the selection of courses which will provide breadth to your University experience and possibly apply to a supportive second major or minor.

Grading Requirement:

All courses taken to fulfill major course requirements must be taken for a letter grade except those courses specified by the department as Credit/No Credit grading only.

Advising Requirement:

Advising is mandatory for all majors in this degree program. Consult your undergraduate advisor for specific information.

The Minor in Physics

Course Requirements for the Minor: 29 units

The following courses, or their approved transfer equivalents, are required of all candidates for this minor.

6 courses required:

MATH 120	Analytic Geometry and Calculus	4.0	FS *
Prerequisites: Completion of ELM requirement; both MATH 118 and MATH 119 (or high school equivalent); a score that meets department guidelines on a department administered calculus readiness exam.			
MATH 121	Analytic Geometry and Calculus	4.0	FS
Prerequisites: MATH 120.			
PHYS 204A	Mechanics	4.0	FS *
Prerequisites: High school physics or faculty permission. Concurrent enrollment in or prior completion of MATH 121 (second semester of calculus) or equivalent.			
PHYS 204B	Electricity and Magnetism	4.0	FS
Prerequisites: MATH 121, PHYS 204A with a grade of C- or higher.			
PHYS 204C	Heat/Wave Motion/Sound/Light	4.0	FS
Prerequisites: MATH 121, PHYS 204A with a grade of C- or higher.			
PHYS 300A	Modern Physics I	3.0	FA
Prerequisites: PHYS 204A, PHYS 204B, PHYS 204C, or PHYS 202A and PHYS 202B and calculus with faculty permission.			

6 units selected from:

Any Physics (PHYS) courses that are not upper-division General Education courses and are numbered 300 or above (except PHYS 489P and PHYS 489T).

The Single Subject Matter Preparation Program in Physics

Course requirements for the Single Subject Matter Preparation Program, 81 units, in conjunction with the Professional Education Program, leads to a Single Subject Teaching Credential.

In most majors, candidates for this credential will normally fulfill the single subject matter preparation program by completing the appropriate education option in the major. Any exceptions to this procedure are noted at the end of this section. In addition to the single subject matter preparation program, completion of an additional professional education program is required to qualify for a California teaching credential. Professional education (credential) programs are available through the School of Education. For prerequisites and other admission requirements to professional education programs, see the "Education" chapter of this catalog.

Your departmental credential advisor is responsible for verifying that the subject matter preparation program has been completed. If you are interested in obtaining a teaching credential, confer with the appropriate credential advisor early in your University career. Department credential advisors can assist you in planning an educational program that meets both major and credential requirements.

Subject matter preparation requirements are governed by state legislative action and approval of the California Commission on Teacher Credentialing. Requirements may change between catalogs. Please consult with your departmental credential advisor for current information.

The General Physics Option described above, along with a professional education program, fulfills all requirements for the Single Subject Teaching Credential Program in Science with a Concentration in Physics.

The Faculty

- Leslie J. Atkins, 2008, Assist Professor, PhD, U Maryland.
- Eric J. Ayars, 2003, Assoc Professor, PhD, No Carolina State U.
- Louis J. Buchholtz, 1986, Professor, PhD, Stanford U.
- Eric R. Dietz, 1983, Professor, PhD, UC Berkeley.
- Chris A. Gaffney, 1987, Chair, Professor, PhD, U Notre Dame.
- David T. Kagan, 1981, Professor, PhD, UC Berkeley.
- Shane D. Mayor, 2008, Research Professor, PhD, U Wisconsin.
- Anna Petrova-Mayor, 2008, Assist Professor, PhD, DEU: University of Hohenheim.
- Xueli Zou, 2000, Assoc Professor, PhD, Ohio State U.

Emeritus Faculty

- Fred L. Boos Jr, 1957, Professor Emeritus, MS, Macalester Coll.
- Cheuk-Kin Chau, 1975, Professor Emeritus, PhD, U Illinois.
- Philip W. Gash, 1986, Professor Emeritus, PhD, U Connecticut.
- Michael R. McGie, 1966, Professor Emeritus, PhD, UC Davis.
- Lorin E. Millet, 1967, Professor Emeritus, PhD, BYU.
- Robert L. Paulson, 1973, Professor Emeritus, PhD, UC Davis.
- John C. Young, 1970, Professor Emeritus, PhD, UC Davis.

Physics Course Offerings

Please see the section on "Course Description Symbols and Terms" in the University Catalog for an explanation of course description terminology and symbols, the course numbering system, and course credit units. All courses are lecture and discussion and employ letter grading unless otherwise stated. Some prerequisites may be waived with faculty permission. Many syllabi are available on the Chico Web.

PHYS 100 Concepts in Physics 3.0 Fa/Spr

A non-mathematical General Education lecture, laboratory-activity course with opportunities for discussion. Topics include Newtonian Mechanics, properties of matter, heat, wave motion, sound, electricity, and light. Not intended for students who have completed high school physics. 2.0 hours activity, 2.0 hours discussion. This is an approved General Education course. (007392)

PHYS 202A General Physics 4.0 Fa/Spr

Prerequisites: High school physics or faculty permission. High school trigonometry and second-year high school algebra or equivalent (MATH 051 and MATH 118 at CSU, Chico). Mechanics, properties of matter, wave motion, sound, heat. Science majors are encouraged to take PHYS 204A instead of this course. 3.0 hours discussion, 3.0 hours laboratory. This is an approved General Education course. Special fee required; see the Class Schedule. (007394)

PHYS 202B General Physics 4.0 Fa/Spr

Prerequisites: PHYS 202A. Light, electricity, magnetism, selected topics in modern physics. Science majors are encouraged to take PHYS 204B instead of this course. Algebra and trigonometry are used. 3.0 hours discussion, 3.0 hours laboratory. Special fee required; see the Class Schedule. (007395)

PHYS 202W Physics Problem Session 1.0 Fa/Spr

Prerequisites: Concurrent enrollment in PHYS 202A. Designed to supplement PHYS 202A with additional applications of introductory physics. Provides the student with the opportunity for additional assistance in developing problem-solving abilities. 2.0 hours activity. You may take this course more than once for a maximum of 6.0 units. Credit/no credit grading only. (007398)

PHYS 202Y Physics Problem Session 1.0 Fa/Spr

Prerequisites: PHYS 202A. Concurrent enrollment in PHYS 202B. Designed to supplement PHYS 202B with additional applications of introductory physics. Provides the student with the opportunity for additional assistance in developing problem-solving abilities. 2.0 hours activity. You may take this course more than once for a maximum of 6.0 units. Credit/no credit grading only. (007399)

PHYS 204A Physics for Students of Science and Engineering: Mechanics 4.0 Fa/Spr

Prerequisites: High school physics or faculty permission. Concurrent enrollment in or prior completion of MATH 121 (second semester of calculus) or equivalent. Vectors, kinematics, particle dynamics, friction, work, energy, power, momentum, dynamics and statics of rigid bodies, oscillations, gravitation, fluids. Calculus used. A grade of C- or higher is required before progressing to either PHYS 204B or PHYS 204C. 3.0 hours discussion, 3.0 hours laboratory. This is an approved General Education course. Special fee required; see the Class Schedule. (007401)

Physics

PHYS 204B	Physics for Students of Science and Engineering: Electricity and Magnetism	4.0 Fa/Spr
Prerequisites: MATH 121, PHYS 204A with a grade of C- or higher. Charge and matter, electric field, Gauss' law, electric potential, capacitors and dielectrics, current and resistance, magnetic field, Ampere's law, Faraday's law of induction, magnetic properties of matter, electromagnetic oscillations and waves. Calculus used. 3.0 hours discussion, 3.0 hours laboratory. Special fee required; see the Class Schedule. (007402)		
PHYS 204C	Physics for Students of Science and Engineering: Heat, Wave Motion, Sound, Light, and Modern Topics	4.0 Fa/Spr
Prerequisites: MATH 121, PHYS 204A with a grade of C- or higher. Temperature, first and second law of thermodynamics, and kinetic theory. Waves in elastic media, standing waves and resonance, and sound. Ray and wave optics, reflection, refraction, lenses, mirrors, diffraction, and polarization. Selected topics in modern physics. Calculus used. 3.0 hours discussion, 3.0 hours laboratory. Special fee required; see the Class Schedule. (007403)		
PHYS 204W	Physics Problem Session	1.0 Fa/Spr
Prerequisites: Concurrent enrollment in PHYS 204A. Designed to supplement PHYS 204A with additional applications of introductory physics. Provides the student with the opportunity for additional assistance in developing problem-solving abilities. 2.0 hours activity. You may take this course more than once for a maximum of 6.0 units. Credit/no credit grading only. (007406)		
PHYS 204Y	Physics Problem Session	1.0 Fa/Spr
Prerequisites: PHYS 204A. Concurrent enrollment in PHYS 204B. Designed to supplement PHYS 204B with additional applications of introductory physics. Provides the student with the opportunity for additional assistance in developing problem-solving abilities. 2.0 hours activity. You may take this course more than once for a maximum of 6.0 units. Credit/no credit grading only. (007407)		
PHYS 204Z	Physics Problem Session	1.0 Fa/Spr
Prerequisites: PHYS 204A. Concurrent enrollment in PHYS 204C. Designed to supplement PHYS 204C with additional applications of introductory physics. Provides the student with the opportunity for additional assistance in developing problem-solving abilities. 2.0 hours activity. You may take this course more than once for a maximum of 6.0 units. Credit/no credit grading only. (007408)		
PHYS 300A	Modern Physics I	3.0 Fall
Prerequisites: PHYS 204A, PHYS 204B, PHYS 204C, or PHYS 202A and PHYS 202B and calculus with faculty permission. This course focuses on the radical changes in our conception of the physical world that emerged in the early 20th century. The course begins with the theory of special relativity, which altered our understanding of the nature of space, time, matter, and energy. The course's middle section is devoted to the early experimental work that spurred the birth of the first quantum theories. The last section introduces the formal quantum dynamics of Schrodinger's equation and applies it to several important physical cases. (007417)		
PHYS 300B	Modern Physics II	3.0 Spring
Prerequisites: PHYS 300A. Application of quantum mechanics to atomic, nuclear, molecular, and solid state physics. Introduction to classical and quantum statistical mechanics. 2.0 hours discussion, 3.0 hours laboratory. (007418)		
PHYS 301A	Analytical Mechanics	3.0 OddFa
Prerequisites: MATH 260, PHYS 204A, PHYS 204B, PHYS 204C. Newton's laws of motion, particle dynamics, accelerated reference systems, central force problems, conservation laws, and celestial mechanics. (007419)		
PHYS 301B	Analytical Mechanics	3.0 EvnSp
Prerequisites: PHYS 301A. Many body systems, rotational motion, rigid body dynamics, Euler's equations, Lagrange's and Hamilton's formulations, oscillating systems and waves. (007421)		
PHYS 302A	Electricity and Magnetism	3.0 EvnFa
Prerequisites: MATH 260, PHYS 204A, PHYS 204B, PHYS 204C. Vector analysis; electrostatic fields and potentials: Poisson's equation, boundary value problems and multipole expansions; dielectrics and magnetostatics. (007422)		
PHYS 302B	Electricity and Magnetism	3.0 OddSp
Prerequisites: PHYS 302A or faculty permission. Magnetic fields in matter, Maxwell's equations, field energy and momentum, Fresnel equations, propagation of electromagnetic waves in dispersive media, waveguides and coaxial cables, radiating systems. (007425)		
PHYS 308	Physics Associates Program	1.0 Fa/Spr
Prerequisites: Faculty permission. See description below. You may take this course more than once for a maximum of 6.0 units. Credit/no credit grading only. (007428)		
PHYS 309	Physics Associates Program	2.0 Fa/Spr
Prerequisites: Faculty permission. See description below. You may take this course more than once for a maximum of 6.0 units. Credit/no credit grading only. (007429)		
PHYS 310	Physics Associates Program	3.0 Fa/Spr
Prerequisites: PHYS 204A, PHYS 204B, PHYS 204C, or PHYS 202A and PHYS 202B, with grade of C- or higher and faculty permission. PHYS 308 - PHYS 310: Student participation in the instructional and professional activities of the Physics Department, particularly related to personalized modes of instruction. Responsibility for some assignments, consultation with students, preparation and conduction of demonstrations, tutoring and evaluation of student learning. Not a research-oriented activity. You may take this course more than once for a maximum of 6.0 units. Credit/no credit grading only. (007430)		
PHYS 312	Computer-Assisted Physics Problem-Solving	3.0 Spring
Prerequisites: PHYS 300A. No previous computer experience necessary. This course prepares physics majors to be self-sufficient in personal computer use to solve experimental and theoretical physics problems. Topics include, but are not limited to, analysis of experimental data, projectile motion, random processes, vector fields and potentials, vibrating systems, and electric circuits. 2.0 hours discussion, 3.0 hours laboratory. (007411)		
PHYS 320	Concepts in Modern Physics	3.0 Fall
Prerequisites: Completion of lower-division Area B General Education. An upper-division General Education Thematic course that explores concepts in relativity, quantum physics, and chaos. The course will emphasize both the conceptual essentials of these theories and the philosophical implications arising from them. Topics will include the nature of space and time, the interplay of measurement and our conception of "reality," the difference between predictability and determinism, and the tension between human understanding and mathematical description. (007414)		
PHYS 341	Advanced Inquiry into Physics	3.0 Fa/Spr
Prerequisites: GEOS 141; or PHYS 100; or PHYS 202A and PHYS 202B; or PHYS 204A, PHYS 204B, and PHYS 204C. This course builds on concepts developed in the introductory physics course in greater mathematical and representational sophistication. There is a significant emphasis on participation in and reflection on scientific inquiry. Topics addressed include kinematics, electrostatics and electro-dynamics, simple machines, and wave phenomena. (020986)		
PHYS 350	Relativity and Albert Einstein	3.0 Fa/Spr
Prerequisites: Upper-division standing. An upper-division General Education thematic course giving an appreciation of Einstein's theory of relativity and his other contributions, including his impact on history, philosophy, politics, art, religion, etc. A 3-unit lecture-discussion course at the conceptual level, with emphasis on writing and critical thinking. (007413)		
PHYS 360	Sound in the Environment	3.0 Fa/Spr
Application of basic principles of physics to a study of acoustics. Topics include measurement of sound, acoustics of musical instruments, electric production of sound, room acoustics, and environmental noise pollution. Especially recommended for music and speech pathology majors. This is an approved General Education course. (007350)		
PHYS 373	Science and Modern Culture	3.0 Fa/Spr
An appreciation of Darwin's theory of evolution, Einstein's theory of relativity, and quantum theory as basic intellectual sources of Modernism, along with an understanding of their relationship to other foundational themes of Modernism, such as Marx's socialism, Nietzsche's perspectivism, and Freud's theory of the unconscious. (007218)		
PHYS 376	Nuclear Science	3.0 Fa/Spr
Properties of nuclei, nuclear systematics, nuclear forces, radioactivity, nuclear fission, nuclear fusion, reactors, weapons, biological effects, waste disposal, nuclear medicine, and the impact of nuclear technology on society. This is an approved General Education course. (007363)		

Highlighted text indicates a change from the original publication.

PHYS 398 Special Topics 1.0–3.0 Spring

This course is for special topics offered for 1.0-3.0 units. Typically the topic is offered on a one-time-only basis and may vary from term to term and be different for different sections. See the Class Schedule for the specific topic being offered. (007415)

PHYS 399 Special Problems 1.0–3.0 Fa/Spr

This course is an independent study of special problems offered for 1.0-3.0 units. You must register directly with a supervising faculty member. You may take this course more than once for a maximum of 6.0 units. Credit/no credit grading only. (007416)

PHYS 415 Thermal Physics 3.0 EvnSp

Prerequisites: MATH 361, PHYS 300A.
Statistical mechanics, the laws of thermodynamics, kinetic theory, states of matter. (007434)

PHYS 424 Nuclear Physics 3.0 Inquire

Prerequisites: PHYS 300B.
Nuclear forces, two-nucleon system, nuclear models, nuclear reactions, radioactive decay, nuclear spin, and magnetism. (007435)

PHYS 425 Solid State Physics 3.0 OddFa

Prerequisites: PHYS 204B, PHYS 204C.
Crystal structure, x-ray diffraction, constants of crystals, lattice vibrations, domains, free electron models, band theory of solids, semi-conductors, transistors, superconductivity, and dislocations. (007436)

PHYS 427 Advanced Laboratory 3.0 Fall

Prerequisites: ENGL 130 (or its equivalent) with a grade of C- or higher, PHYS 300B.
Experiments involving x-rays, radioactivity, Compton effect, photoelectric effect, velocity of light, lasers, nuclear magnetic resonance, electron spin resonance, Mossbauer effect, including data analysis by high speed computer. 2.0 hours discussion, 3.0 hours laboratory. This is a writing proficiency, WP, course; a grade of C- or better certifies writing proficiency for majors. (007437)

PHYS 433 Fiber Optics/Telecommunications 3.0 Spring

Prerequisites: PHYS 450 or PHYS 451.
Review light wave transmission in dielectric media; study the components of fiber optic communication, investigate analog and digital, and multiplexing techniques; examine the system performance criteria, measurements, and design. 2.0 hours discussion, 3.0 hours laboratory. (007440)

PHYS 435A Quantum Mechanics 3.0 Fall

Prerequisites: MATH 361, PHYS 300A.
Plane waves, wave packets, De Broglie waves, Schrodinger's equation, probability, simple harmonic oscillator, angular momentum, and hydrogen atom. (007441)

PHYS 435B Quantum Mechanics 3.0 Spring

Prerequisites: PHYS 435A.
Operator methods, matrix mechanics, approximation methods, multielectron atoms, and scattering theory. (007444)

PHYS 450 Optics 3.0 Spring

Prerequisites: PHYS 204A, PHYS 204B, PHYS 204C.
Geometrical and physical optics, interference, diffraction, reflection, dispersion, resolution, polarization, fiber optics, laser optics, and holography. 2.0 hours discussion, 3.0 hours laboratory. This course is also offered as EECE 450. (002549)

PHYS 451 Lasers and Their Applications 3.0 Fall

Prerequisites: PHYS 204C. Recommended: EECE 450 or PHYS 450.
The theory and mechanism of laser action, various types of lasers and their applications and future use. Laboratory involves measurements with lasers, fiber optics, data transmission, and holography. 2.0 hours discussion, 3.0 hours laboratory. This course is also offered as EECE 451. (002550)

PHYS 470 Electronic Physics 3.0 Inquire

Prerequisites: MATH 260, PHYS 204B.
Circuit review, solid state devices, charged particle dynamics, analog and digital integrated circuits, applications. 2.0 hours discussion, 3.0 hours laboratory. (007445)

PHYS 480 Theoretical Physics 3.0 Inquire

Prerequisites: MATH 260, PHYS 204A, PHYS 204B, PHYS 204C, faculty permission.
Advanced topics in theoretical physics appropriate to needs of students. (007446)

PHYS 489P Internship in Professional Physics 3.0 Fa/Spr

Prerequisites: PHYS 300B and faculty permission.
This is a supervised internship in professional physics. This internship may take place at a university, government laboratory, or private sector company. This course may be taken more than once. It cannot be used for the minor in physics. You may take this course more than once for a maximum of 15.0 units. Credit/no credit grading only. (007447)

PHYS 489T Internship in Physics Teaching 3.0 Fa/Spr

Prerequisites: PHYS 300B and faculty permission.
This is a supervised internship in physics teaching which will take place in a local high school physics classroom. This course may be taken more than once, but a maximum of 3 units of any PHYS 289 may be counted toward the degree. This course cannot be used for the minor in physics. You may take this course more than once for a maximum of 15.0 units. Credit/no credit grading only. (007448)

PHYS 491 Physics Seminar 1.0 Spring

Prerequisites: Upper-division standing in physics.
Presentation and discussion of reports based on current physics literature and/or special studies of students and faculty. You may take this course more than once for a maximum of 6.0 units. (007449)

PHYS 498 Special Topics 1.0–3.0 Inquire

Prerequisites: Upper-division standing in physics, faculty permission.
This course is for special topics offered for 1.0-3.0 units. Typically the topic is offered on a one-time-only basis and may vary from term to term and be different for different sections. See the Class Schedule for the specific topic being offered. (007450)

PHYS 499 Independent Study 1.0–3.0 Fa/Spr

This course is an independent study of special problems and is offered for 1.0-3.0 units. You must register directly with a supervising faculty member. You may take this course more than once for a maximum of 6.0 units. Credit/no credit grading only. (007451)

PHYS 697 Independent Study 1.0–4.0 Fa/Spr

This course is a graduate-level independent study offered for 1.0-4.0 units. You must register directly with a supervising faculty member. You may take this course more than once for a maximum of 6.0 units. (007456)

PHYS 699T Master's Thesis 1.0–6.0 Fa/Spr

This course is offered for 1.0-6.0 units. You must register directly with a supervising faculty member. You may take this course more than once for a maximum of 6.0 units. (007461)