

PROGRAMS AVAILABLE

BACHELOR OF ARTS IN PHYSICS BACHELOR OF SCIENCE IN PHYSICS PHYSICS MINOR TEACHING LICENSURE

PHYSICS MAJOR PROGRAM

The Department of Physics offers a four-year program leading to a Bachelor of Arts or Science in Physics. Students study basic physical laws of nature, apply these laws in the laboratory, and explore practical applications found in technological society. Opportunities are available for advanced study in electronics, solid state physics, lasers, vacuum technology, astrophysics and astronomy, computer applications, and elementary particle physics. Upon graduation, students are prepared to enter graduate school in physics or related scientific and engineering fields or to enter directly into the scientific or technological community. An undergraduate degree in physics is also an excellent foundation for graduate work in architecture, law, medicine, business administration, and a host of other fields.

Students graduating with a degree in physics will be able to:

- C solve problems and apply established procedures that yield positive results;
- C look at experimental evidence or theoretical projections and extract from these meaningful results;
- C communicate information gained in their work to others, by written and oral means;
- C conduct meaningful experimentation as a means of evaluation of ideas and verification of theory;
- C use mathematics to analyze problems and generalize results;
- C use modern computational methods to provide mathematical representations of physical problems;
- C understand the basic principles in the various fields of physics;
- C work with laboratory apparatus and measurement instrumentation, understanding laboratory procedures and techniques.

Physics Major Requirements

The physics program requires students to complete particular courses to meet their core curriculum requirements and to satisfy prerequisites for physics courses or to provide evidence of competency in these areas.

Bachelor of Arts:

Students must show a mathematical proficiency equivalent to courses through Calculus IV

PHYS 151 Introduction to Physics I	4 cr
PHYS 152 Introduction to Physics II	4 cr
PHYS 251 Introduction to Physics III	4 cr
PHYS 252 Introduction to Physics IV	4 cr
PHYS 391 Methods of Experimental Physics I	3 cr
PHYS 401 Advanced Physics Laboratory I	3 cr
PHYS 451 Modern Physics I	3 cr
PHYS 452 Modern Physics II	3 cr
PHYS 480 Physics Seminar	3 cr
Physics electives	<u>6 cr</u>

TOTAL PHYSICS BACHELOR OF ARTS 37

Bachelor of Science:

MATH 150	Precalculus	3 cr
MATH 220	Calculus I	3 cr
MATH 320	Calculus II	3 cr
MATH 330	Calculus III	3 cr
MATH 380	Differential Equations	3 cr
PHYS 151	Introduction to Physics I	4 cr
PHYS 152	Introduction to Physics II	4 cr
PHYS 251	Introduction to Physics III	4 cr
PHYS 252	Introduction to Physics IV	4 cr
PHYS 301	Mechanics I	3 cr
PHYS 302	Mechanics II	3 cr
PHYS 303	Electricity and Magnetism I	3 cr
PHYS 304	Electricity and Magnetism II	3 cr
PHYS 391	Methods of Experimental Physics I	3 cr
PHYS 392	Methods of Experimental Physics II	3 cr
PHYS 401	Advanced Physics Laboratory I	3 cr
PHYS 402	Advanced Physics Laboratory II	3 cr
PHYS 451	Modern Physics I	3 cr
PHYS 452	Modern Physics II	3 cr
PHYS 460	Statistical Thermodynamics	3 cr
PHYS 461	Mathematical Physics I	3 cr
PHYS 462	Mathematical Physics II	3 cr
PHYS 471	Quantum Mechanics I	3 cr
PHYS 472	Quantum Mechanics II	3 cr
PHYS 480	Physics Seminar	<u>3 cr</u>

TOTAL PHYSICS BACHELOR OF SCIENCE 79

PHYSICS

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PHYSICS MINOR PROGRAM

Students who minor in physics will obtain a firm foundation in both scientific techniques and physical content. In addition to a comprehensive study of the major area of physics, the student will gain a depth of knowledge in specific fields through study in upper-division courses.

Physics Minor Requirements

PHYS	151	Introduction to Physics I	4 cr
PHYS	152	Introduction to Physics II	4 cr
PHYS	251	Introduction to Physics III	4 cr
PHYS	252	Introduction to Physics IV	4 cr

Select 6 credits from: 6 cr

PHYS	301	Mechanics I
PHYS	302	Mechanics II
PHYS	303	Electricity and Magnetism I
PHYS	304	Electricity and Magnetism II
PHYS	451	Modern Physics I
PHYS	452	Modern Physics II

TOTAL PHYSICS MINOR REQUIREMENTS **22**

TEACHING LICENSURE

Students majoring in physics may opt to pursue initial teacher licensure as an early childhood teacher or elementary teacher. Also, physics majors may pursue initial licensure as a teacher of physics for the middle school or secondary levels. Students seeking any of these licensures must complete a physics major, education major, and a licensure program in education.

ROBOTICS ARTS

The Physics Department is home to the College's Robotic Arts Project. Students majoring in physics may involve themselves in the many aspects of robotics programming, design and construction that take place within the Department.

COURSE LISTINGS

PHYS 100 Physics Concepts: The Natural Laws

3 cr

Provides the historical background of the study of natural laws, investigates the basic laws of nature, and emphasizes man's place in a modern technological world. Required laboratory. For those not majoring in the physical sciences.

Prerequisite: None

PHYS 120 Introduction to Engineering

4 cr

Introduces students to basic scientific methodology, current problems and fundamental principles of engineering design. Intended for nonscience majors and potential engineering students. Required laboratory introduces fundamental science and engineering principles through collaborative projects such as robotics.

Prerequisite: None

PHYS 131 General Physics I

4 cr

This is the first of a two-semester sequence, designed primarily for students in the biological and health sciences and others who desire a rigorous but non-calculus-based course that presents a complete introduction to physics. Covers vectors, one and two dimensional motion, Newton's laws, and rotational motion, conservation of energy and momentum, gravitation, wave motion, sound, heat, and thermodynamics. Required laboratory.

Prerequisite: None

PHYS 132 General Physics II

4 cr

This is the second of a two-semester sequence, designed primarily for students in the biological and health sciences and others who desire a rigorous but non-calculus-based course that presents a complete introduction to physics. Covers geometrical optics, electricity and magnetism, electronics, modern physics, relativity. Required laboratory.

Prerequisite: PHYS 131

PHYS 151 Introduction to Physics I

4 cr

Presents a unified view of physics including dynamics, statics, forces, work and energy, the conservation laws, vectors, experimental techniques. Required laboratory. For those wishing an in-depth understanding of natural laws.

Prerequisite: None

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PHYSICS

- PHYS 152 Introduction to Physics II** **4 cr**
Continues the studies of Introduction to Physics I. Rotational dynamics, angular momentum, moment of inertia, simple harmonic motion. Waves, acoustics, heat, and thermodynamics. Required laboratory.
Prerequisite: PHYS 151 or department approval
- PHYS 220 Astronomy** **4 cr**
Looks at historical and modern aspects of astronomy. Topics covered will include: Earth-Moon System, solar system, galaxy, observable Universe, as well as current research in astronomy including quasars, pulsars, black holes, the search for extraterrestrial life. Required laboratory, observing sessions.
Prerequisite: None
- PHYS 230 Astronomy and Astrophysics** **3 cr**
Investigates astronomical phenomena and their physics. The Sun and basic stellar characteristics; electromagnetic radiation and matter; the Hertzsprung-Russell diagram and stellar distances, and evolution; the structure and content of our galaxy; extra galactic objects; cosmology.
Prerequisite: MATH 150 or MATH 220
- PHYS 241 Scientific Computing I** **3 cr**
Examines the use of computers in the physical sciences. Uses computers to solve scientific problems through the use of numerical methods. Examples will be drawn from the physical and life sciences. Uses specialized computer software such as Mathematica and MathCAD, and general programming languages such as True Basic and spreadsheets.
Prerequisite: MATH 220, 320 or department approval
- PHYS 242 Scientific Computing II** **3 cr**
Continues Scientific Computing I.
Prerequisite: PHYS 241 or department approval
- PHYS 251 Introduction to Physics III** **4 cr**
The third of a four-part course and an extension of the work of Introduction to Physics I and II utilizing the more advanced mathematical techniques acquired during the freshman year. Studies electricity, magnetism, and optics. Required laboratory.
Prerequisite: PHYS 152 and familiarity with basic calculus
- PHYS 252 Introduction to Physics IV** **4 cr**
The fourth part of a four-semester sequence, continuing coverage from PHYS 251. Primary focus is on modern physics. Required laboratory.
Prerequisite: PHYS 251
- PHYS 261 Electronics I** **3 cr**
Examines basic electronics, including AC-DC circuits, passive networks, transient analysis, semiconductor device theory (transistors, diodes, integrated circuits), design of amplifiers and digital circuits. Use of integrated circuits (op-amps, switching circuits). Required laboratory.
Prerequisite: PHYS 251
- PHYS 262 Electronics II** **3 cr**
Logic design, computer circuits, microprocessors. Interfacing computers for data acquisitions and for control applications. Studies sensory devices and their use for data gathering. Required laboratory.
Prerequisite: PHYS 261 or department approval
- PHYS 301 Mechanics I** **3 cr**
The first of a two-part course for science majors and math majors wishing a course emphasizing mathematical applications: particle motion, rigid bodies, moving coordinate systems, two- and three-dimensional motion, systems of particles, continuous media.
Prerequisite: PHYS 252 and MATH 380
- PHYS 302 Mechanics II** **3 cr**
Studies Lagrange's equations, theory of small vibrations, generalized coordinates, introduction to tensors, and special relativity.
Prerequisite: PHYS 301

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- PHYS 303 Electricity and Magnetism I** **3 cr**
Studies electrostatics, magnetic fields, electromagnetic properties of matter, conductivity, electrostatic and magnetic energy. The first of a two-part course.
Prerequisite: PHYS 252 and MATH 380
- PHYS 304 Electricity and Magnetism II** **3 cr**
Studies Maxwell's equations, electrodynamics.
Prerequisite: PHYS 303
- PHYS 391 Methods of Experimental Physics I** **3 cr**
Supplements theory of other courses with detailed laboratory techniques and statistical treatment of experimental data. Use of current computer technology is integral. Required laboratory.
Prerequisite: PHYS 302 and PHYS 304 (these courses may be taken concurrently)
- PHYS 392 Methods of Experimental Physics II** **3 cr**
Vacuum technology, lasers, holography, and use of current computer technology is integral. Required laboratory.
Prerequisite: PHYS 391
- PHYS 401 Advanced Physics Laboratory I** **3 cr**
Studies laboratory techniques to supplement senior physics courses or work on special projects with departmental approval. Use of current computer technology is integral.
Prerequisite: PHYS 392
- PHYS 402 Advanced Physics Laboratory II** **3 cr**
Continues Physics 401. Use of current computer technology is integral.
Prerequisite: PHYS 401
- PHYS 451 Modern Physics I** **3 cr**
Studies the Bohr theory of the atom, harmonic oscillator, classical and modern analogs, relativistic transformations, and introduction to special relativity.
Prerequisite: PHYS 302 and 304
- PHYS 452 Modern Physics II** **3 cr**
Studies special relativity, quantum mechanics, nuclear and elementary particle phenomena.
Prerequisite: PHYS 451
- PHYS 460 Statistical Thermodynamics** **3 cr**
Studies statistical techniques applied to physical phenomena. Classical thermodynamics, statistical mechanics, kinetic theory of gases.
Prerequisite: PHYS 301 and 304
- PHYS 461 Mathematical Physics I** **3 cr**
Presents mathematical methods of use in the solution of physical problems. Vector calculus and matrix techniques, complex variables, differential equations, transformations, distribution theory.
Prerequisite: MATH 330
- PHYS 462 Mathematical Physics II** **3 cr**
Focuses on series and integrals, variational techniques, generalized coordinate systems, and generating functions.
Prerequisite: PHYS 461
- PHYS 471 Quantum Mechanics I** **3 cr**
Studies inadequacy of classical mechanics; wave-particle quality, uncertainty principle; Schrodinger equation, expectation values; operator formalism, angular momentum; simple systems; simple harmonic oscillators and the hydrogen atom; matrix representation.
Prerequisite: PHYS 301
- PHYS 472 Quantum Mechanics II** **3 cr**
Examines representation theory: Hilbert space, unitary transformations, canonical transformations, scattering, approximations, perturbation methods and variational methods, the WKB approximation, quantum statistics, many body system, electromagnetic interactions, the Dirac equation.
Prerequisite: PHYS 471

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- PHYS 480 Physics Seminar** **3 cr**
Discusses special physics topics of interest to students and faculty.
Prerequisite: Department approval
- PHYS 500 Directed Independent Study** **1-3 cr**
Open to juniors and seniors who wish to read in a given area or to study a topic in depth. Written reports and frequent conferences with the advisor are required.
Prerequisite: Junior/senior status; department approval
- PHYS 510 Independent Research** **1-3 cr**
Participation in research in physics under the direction of a member of the physics faculty in a specific area.
Prerequisite: Department approval
- PHYS 540 Internship** **3-15 cr**
Offers the upper-level physics major an opportunity to practice physics in an appropriate professional situation. The student will work with a faculty sponsor and an off-campus supervisor in gaining experience significant to the major.
Prerequisite: Department approval; junior/senior status
- PHYS 580 Special Topics in Physics** **1-4 cr**
Studies concepts, problems, issues, topics, or themes that are important in the field of physics. Special topic seminars may explore a variety of topics including, but not limited to: physics for educators, solid state physics, robotics, and engineering applications. Lab may be required depending on topic.
Prerequisite: Department approval