Physics

Physics is a fundamental science from which nearly all of modern engineering and technology has emerged, and its perspectives on theory and experimentation continue to influence profoundly the evolution of all sciences. It addresses all domains, from the submicroscopic worlds of atoms and quarks to the vast realms of space, from the esoteric to the mundane. It requires imagination and persistence from those who would participate.

The Department of Physics offers a flexible assortment of course work, laboratories, and guided research. Its laboratories are complemented by a variety of general and specialized apparatus; computers are employed in most aspects of experimentation and analysis, at all levels.

Programs

- Science Education, B.S. (Physics Specialty (Teacher Licensure)) *major*
- Physics *minor*

Career Directions

Government Laboratories
High School Teaching
Industry Laboratories
Post-Secondary Teaching
Also: Graduate and Professional Schools

Preparation

Recommended High School Courses
Advanced Mathematics
Physics
Chemistry
Computer Programming

Science Education, B.S. *major*
Physics Specialty (Teacher Licensure)

Required Credits: 83
Required GPA: 2.50

Core Courses for Science Teaching in Grades 5-8

COMPLETE THE FOLLOWING COURSES:

- BIOL 1211 Introductory Biology I (4 credits)
  or BIOL 1110 Human Biology (4 credits)
- BIOL 1212 Introductory Biology II (4 credits)
  or BIOL 1120 General Biology: Evolution And Ecology (3 credits)
- CHEM 2211 Principles of Chemistry I (4 credits)
  or CHEM 1111 General Chemistry I (4 credits)
- CHEM 2212 Principles of Chemistry II (4 credits)
  or CHEM 1112 General Chemistry II (4 credits)
- GEOL 1110 Physical Geology (4 credits)
- SCI 3100 Integrative Science for Teachers (4 credits)
- SCI 3450 Science Methods For Grades 5-8 (4 credits)
  or ED 3410 Secondary Science Methods (4 credits)

REQUIRED PROFESSIONAL EDUCATION COURSES

COMPLETE THE FOLLOWING COURSES WITH A MINIMUM 3.0 GPA:

- ED 3100 Introduction to the Foundations of Public School Education (3 credits)
- ED 3110 Educational Psychology (3 credits)
- ED 3140 Human Relations In Education (3 credits)
- ED 3350 Pedagogy: Planning for Instruction (3 credits)
- ED 3780 Adaptation and Management: Designing the Learning Environment (3 credits)
- ED 4737 Content Area Reading (3 credits)
- ED 4799 The Professional Teacher (1 credit)

COMPLETE THE FOLLOWING COURSE:

- HLTH 3400 Health and Drugs in Society (2 credits)

Complete 12 credits of student teaching:

- ED 4830 Student Teaching - Secondary (1-12 credits)

PHYSICS SPECIALTY

COMPLETE THE FOLLOWING COURSES:

MATH 2471 is recommended (required for PHYS 2101)

- PHYS 2101 Physics I (5 credits)
  or PHYS 1101 General Physics I (4 credits)
- PHYS 2102 Physics II (5 credits)
  or PHYS 1102 General Physics II (4 credits)
- PHYS 2500 Electronics I (4 credits)
- PHYS 3103 Physics III (4 credits)
- PHYS 4580 Optics (4 credits)

COMPLETE THE FOLLOWING COURSE:

- PHYS 4980 Research (3 credits)

Physics *minor*

Required Credits: 30
Required GPA: 2.00

I REQUIRED COURSES

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COMPLETE THE FOLLOWING COURSES:

- MATH 2471 Calculus I (5 credits)
- MATH 2472 Calculus II (5 credits)
- PHYS 2101 Physics I (5 credits)
- PHYS 2102 Physics II (5 credits)
- PHYS 3103 Physics III (4 credits)

II REQUIRED ELECTIVES

SELECT 6 SEMESTER CREDITS FROM PHYSICS COURSES

OR COMPLETE THE FOLLOWING COURSES:
(SOME COURSES IN THIS SECTION REQUIRE PREREQUISITES THAT ARE NOT PART OF THIS PROGRAM)

- CHEM 4711 Physical Chemistry I (3 credits)
- CHEM 4712 Physical Chemistry II (3 credits)
- ANY PHYSICS COURSE NUMBERED 3150 OR ABOVE

Physics Courses

PHYS 1101 General Physics I (4 credits)
A survey of introductory physics, with laboratory. Topics include mechanics, vibrations, fluids, waves, heat, electricity, magnetism, dc circuits, optics. Elementary algebra and trigonometry are employed as needed. (Not for Physics or Engineering majors.) Liberal Education Goal Area 3 (LC).

PHYS 1102 General Physics II (4 credits)
Continuation of a survey of introductory physics, with laboratory. Topics include mechanics, vibrations, fluids, waves, heat, electricity, magnetism, DC circuits, optics. Elementary algebra and trigonometry are employed as needed. (Not for Physics or Engineering majors.) Liberal Education Goal Area 3 (LC).

PHYS 1230 Introduction to Engineering (2 credits)
Overview of career prospects and issues in engineering. Students research career paths in light of their own personal inventories and prepare plans for professional development. Employment statistics, qualifications, disciplinary tools, the design process, team building, professional associations, licensure, ethics. Visits to industrial engineering departments provide a first-hand look and networking/internship opportunities.

PHYS 2101 Physics I (5 credits)
A calculus-based introductory physics sequence, with laboratory. Topics include mechanics, vibrations, waves, fluids, thermodynamics, electricity, magnetism, DC and AC circuits, optics. Prerequisite/corequisite: MATH 2471. Liberal Education Goal Area 3 (LC).

PHYS 2102 Physics II (5 credits)
Continuation of a calculus-based introductory physics sequence, with laboratory. Topics include mechanics, vibrations, waves, fluids, thermodynamics, electricity, magnetism, DC and AC circuits, optics. Prerequisite/corequisite: MATH 2472. Liberal Education Goal Area 3 (LC).

PHYS 2150 Acquisition and Control with G Programming (3 credits)
In-depth introduction to laboratory electronics and computer data acquisition/process control using National Instruments' LabVIEW programming language. Measurement transducers, instrumentation, interface hardware and communications protocols, A/D and D/A conversion, signal conditioning, and data analysis covered in hands-on laboratory format. Prerequisite: One or more basic science courses.

PHYS 2210 Statics and Strength of Materials (3 credits)
Analysis of loads and moments borne by non-accelerating bodies and structures, considering distribution of forces and moments, material deformation, and prediction of material failure. Prerequisite: PHYS 2101.

PHYS 2220 Dynamics (3 credits)
Dynamics force and moment systems, including applications to systems of particles and rigid bodies, with an engineering emphasis. Prerequisite: PHYS 2101.

PHYS 2500 Electronics I (4 credits)
Use and analysis of digital ICs, with application to computer circuitry and interfacing. Intensive laboratory. Corequisite: PHYS 1101 or PHYS 2101, or consent of instructor.

PHYS 2951 Study Travel Physics (1-6 credits)
Study Travel course in Physics for Lib Ed Goal Area 3.

PHYS 3103 Physics III (4 credits)
An introductory course on modern physics. Topics include special relativity, quantum mechanics, atomic physics and radiation, elementary particles, and astrophysics. Lecture and Laboratory. Prerequisites: PHYS 2102, MATH 2472, or consent of instructor.

PHYS 3150 Circuit Analysis (4 credits)
A study of electrical systems and their responses to excitations, Two-port networks, and Bode Plots; Laplace and Fourier Transforms are employed as needed. Register for separate laboratory. For Physics majors - Prerequisites: PHYS 2102. For non-Physics majors - Prerequisites: PHYS 1102; Corequisite: MATH 2472.

PHYS 3230 Fluid Mechanics (3 credits)
The dynamics of fluid flow, emphasizing energy and momentum methods. Prerequisite: PHYS 2220. (Might not be offered every year.)

PHYS 3250 Acoustics and Vibrations (3 credits)
An introduction to vibrations, with applications to engineering and acoustics. Lecture and laboratory. Prerequisites: PHYS 2102, PHYS 2220 and MATH 2490 or PHYS 3400. (Might not be offered every year.)

PHYS 3270 Systems and Controls (4 credits)
Modeling and analysis of dynamic systems, with control applications. Register for separate laboratory. Prerequisites: PHYS 2220, PHYS 2530, and MATH 2490 or PHYS 3400, or consent of instructor.

PHYS 3300 Thermodynamics and Heat Transfer (3 credits)
Study of the theory and application of the laws of thermodynamics to control volumes, including an introduction to thermodynamic cycles for power generation, refrigeration, and heat pumps. Also, a study of the transfer of energy via heat, work, and mass, and of applications for the law of entropy. Prerequisites: MATH 2472 and PHYS 2102. (Might not be offered every year.)

PHYS 3400 Mathematical Physics (3 credits)
Introduction to mathematical techniques used to solve problems in the physical sciences. Topics include complex analysis, vector fields, Fourier series, ordinary and partial differential equations, and series solutions. Prerequisites: MATH 2472 and PHYS 2102.

PHYS 3500 Electronics II (4 credits)
Application of op-amps and other linear ICs and devices to instrumentation, measurement, interfacing, and control. Intensive laboratory. Prerequisite: PHYS 1102 or PHYS 2102 or consent of instructor.

PHYS 3720 Advanced Laboratory (1 credit)
A laboratory designed to supplement various pre-engineering and other advanced courses that currently have no laboratory component. Content varies with term, may be subtitled, and may be repeated. Prerequisite: PHYS 2102.

PHYS 4120 Engineering Simulation and Design (2 credits)
Engineering design and analysis with commercial and customized software. A project is required. Prerequisite: PHYS 2102. (Might not be offered every year.)

PHYS 4310 Mathematical Methods in Applied Physics (3 credits)
Advanced topics in mathematical physics and engineering, including vector calculus, partial differential equations, Sturm-Liouville theory of orthogonal functions, and eigenfunction expansions. Prerequisite: PHYS 2102, and MATH 2490 or PHYS 3400. (Might not be offered every year.)

PHYS 4540 Electromagnetic Fields and Waves (4 credits)
A study of applied electromagnetics. Topics include Maxwell's Equations boundary value problems, static fields, media, waves, waveguides, and antennas. Prerequisites: PHYS 2102, MATH 2490 (or PHYS 3400), PHYS 3103, and PHYS 4310 (or consent of instructor). (Might not be offered every year.)

PHYS 4580 Optics (4 credits)
Geometrical and Physical Optics, including Fraunhofer and Fresnel diffraction, coherence, and holography. Fourier analysis is employed as needed. Lecture and laboratory. Prerequisites: PHYS 2102, and MATH 2490 or PHYS 3400. (Might not be offered every year.)

PHYS 4610 Quantum Mechanics (3 credits)
Development and formulation of quantum mechanics, with selected applications in spectroscopy, atomic/nuclear structure, lasers, solid state. Prerequisites: PHYS 2102, PHYS 3103, MATH 2490 or PHYS 3400, and PHYS 4310. (Might not be offered every year.)

PHYS 4660 Solid State Physics (3 credits)
Fundamentals of condensed matter physics, emphasizing crystalline solids. Includes transport mechanisms, band theory, semiconductors, lasers. Prerequisites: PHYS 2102, MATH 2472, and PHYS 3103. PHYS 4610 is strongly recommended. (Might not be offered every year.)

PHYS 4680 Theoretical Physics (4 credits)
Advanced topics in electromagnetism, classical mechanics, and quantum mechanics. Prerequisites: PHYS 2220, PHYS 4310, PHYS 4540, and PHYS 4610. (Might not be offered every year.)

PHYS 4720 Applied Controls (2 credits)
Calculus-based theory of feedback control systems with applications to industrial and experimental research automation systems. Includes laboratory component. Prerequisite: PHYS 1102 or PHYS 2102, and MATH 2490 or PHYS 3400.

PHYS 4751 Engineering Design Project I (2 credits)
Advanced computer-based measurement and control techniques, transducers, interfacing, signal conditioning. Prerequisites: PHYS 2102, senior status or consent of instructor.

PHYS 4752 Engineering Design Project II (2 credits)
Continuation of advanced computer-based measurement and control techniques, transducers, interfacing, signal conditioning. Prerequisites: PHYS 2102, senior status or consent of instructor.

PHYS 4980 Research (3 credits)
Research carried out by the student that is based on appropriate methodology and scholarship.

All-University Courses

The course numbers listed below, not always included in the semester class schedule, may be registered for by consent of the advisor, instructor, or department chair, or may be assigned by the department when warranted. Individual registration requires previous arrangement by the student and the completion of any required form or planning outline as well as any prerequisites.

1910, 2910, 3910, 4910 DIRECTED INDEPENDENT STUDY
1920, 2920, 3920, 4920 DIRECTED GROUP STUDY
1930, 2930, 3930, 4930 EXPERIMENTAL COURSE
1940, 2940, 3940, 4940 IN-SERVICE COURSE
1950, 2950, 3950, 4950 WORKSHOP, INSTITUTE, TOUR
1960, 2960, 3960, 4960 SPECIAL PURPOSE INSTRUCTION
1970, 2970, 3970, 4970 INTERNSHIP
1980, 2980, 3980, 4980 RESEARCH
1990, 2990, 3990, 4990 THESIS