

PHYSICS (PHYS)

PHYS 221. General Physics I. (4 Credits)

Newtonian mechanics, energy, waves, and heat. Non-calculus based. Four hours lecture, three hours laboratory. Prerequisite: Pre-calculus (algebra and trigonometry) competence. Not open to students with prior credit for PHYS 231 or 233.

Tags: SP

PHYS 222. General Physics II. (4 Credits)

Electromagnetism, optics, and modern physics. Non-calculus based. Four hours lecture, three hours laboratory. Prerequisite: PHYS 221. Not open to students with prior credit for PHYS 232 or 234.

PHYS 231. Introductory Physics I. (4 Credits)

Kinematics, Newtonian dynamics, conservation laws, and selected topics from oscillations, waves, fluids, and thermodynamics. Four hours lecture, three hours laboratory. Corequisite or Prerequisite: MATH 235.

Tags: SP

PHYS 232. Introductory Physics II. (4 Credits)

Electricity and magnetism, optics, and selected topics from modern physics, waves, and thermodynamics. Four hours lecture, three hours laboratory. Prerequisite: PHYS 231. Pre or Corequisite: MATH 236.

PHYS 294. Physics for the Future. (2 Credits)

The beginning of an exciting journey into the intricacies of our created world. Includes discussion of recent physics breakthroughs, exposure to research at Wheaton and at nearby national laboratories, discussion of vocational pathways, and thoughts on the relationship of physics to the liberal arts and the Christian faith. (lin)

PHYS 305. Dakota Skies: Astronomy and Atmospheric Science in the Black Hills. (4 Credits)

An introduction to the study of the weather and the universe. Topics include physical foundations for astronomy and atmospheric science, the evolution of stars, the structure and origin of the universe, the structure of the earth's atmosphere, weather systems, weather analysis and forecasting. Special attention will be given to sound scientific practices, including systematic scientific investigations, critical evaluation of scientific claims and the ability to develop a sound scientific argument.

PHYS 331. Spacetime and Quanta. (4 Credits)

Special Relativity, Quantum Mechanics, and selected topics from Atomic Physics, Statistical Physics, Nuclear Physics, Particle Physics, Solid State Physics, and Cosmology. Four hours lecture. Prerequisites: PHYS 232 and PHYS 334. Co or Prerequisite: MATH 333.

PHYS 334. Computer Modeling of Physical Systems. (2 Credits)

An introduction to computer methods for the analysis, modeling and simulation of physical systems and analysis of experimental data. Applications taken from mechanics, fluids, electricity and magnetism. Cross-listed with ENGR 334. Prerequisite: PHYS 231 and MATH 235. Pre or Corequisite: MATH 236.

PHYS 341. Analytical Mechanics. (4 Credits)

Particle and rigid body dynamics, central forces and gravitation, rotating systems and bodies, Lagrange and Hamilton formulations, generalized coordinates, and normal modes. Prerequisite: PHYS 334 and MATH 333. Pre or Corequisite: MATH 237.

PHYS 342. Electromagnetic Theory. (4 Credits)

Electrostatics, steady currents, linear materials, electromagnetic induction, Maxwell's equations, and electromagnetic waves. Alternate years. Prerequisite: PHYS 334 and MATH 237. Pre or Corequisite: MATH 333.

PHYS 343. Methods of Experimental Physics. (2 Credits)

Design of scientific investigations; experimental methods and instrumentation; construction of scientific arguments from data. Six hours laboratory. Prerequisites: PHYS 334 and Junior or higher standing. (lin)

PHYS 344. Quantum Mechanics. (4 Credits)

Elements of quantum physics, solutions of Schrödinger's equation applied to atomic and molecular structure, applications, interpretations. Alternate years. Prerequisite: PHYS 331 and 334; and MATH 237, 245, and 333.

PHYS 345. Methods of Data Analysis and Presentation. (2 Credits)

Development of skills in data and error analysis, technical communication, and scientific argument. Prerequisite: PHYS 334 and Writing and Communication Competencies.

PHYS 351. Analog Electronics. (2 Credits)

Basic principles of electronic circuits and devices. AC and DC circuit fundamentals, filters, diodes, transistors, amplifiers, and operational amplifiers. Four hours lecture, three hours laboratory. Cross-listed with ENGR 351. Prerequisite: PHYS 232. Pre or Corequisite: PHYS 334.

PHYS 352. Computer Data Acquisition. (2 Credits)

Digital electronics, analog to digital conversion, computer interfacing, and data acquisition with LabVIEW software. Four hours lecture, three hours laboratory. Prerequisite: PHYS 351. Alternate years. Course is offered occasionally.

PHYS 354. Advanced Optics. (2 Credits)

Light propagation in matter, polarization, Fourier optics, aberrations, holography, lasers, and modern optical materials and components. Four hours lecture, three hours laboratory. Alternate years. Course is offered occasionally. Prerequisite: PHYS 232.

PHYS 359. Thermodynamics. (4 Credits)

Theory of heat and gases, introduction to kinetic theory and statistical mechanics. Alternate years. Prerequisites: PHYS 232 and PHYS 334.

PHYS 361. Solid State Physics and Nanotechnology. (2 Credits)

Bonding and structure of crystals, electronic properties of insulators, semiconductors, metals, and superconductors, limits of smallness, molecular assembly, and nanoscale physics. Prerequisite: PHYS 344 or CHEM 371. Alternate years. Course is offered occasionally.

PHYS 362. Plasma Physics. (2 Credits)

Introduction to plasma physics including definition of a plasma, single particle and guiding center motions, fluid descriptions, waves, instabilities, and applications of plasma physics in space and astrophysics, controlled thermonuclear fusion, and industry. Pre or Corequisite: PHYS 342. Alternate years. Course is offered occasionally.

PHYS 363. Introduction to Medical Physics. (2 Credits)

A survey of radiation therapy, nuclear medicine, diagnostic imaging, and health physics with discussion on ethical and stewardship concerns of these technologies. Prerequisites: PHYS 222 or PHYS 331. Course is offered occasionally.

PHYS 366. Particle Physics and Cosmology. (2 Credits)

Elementary particles, fundamental interactions, conservation laws and symmetries, big bang cosmology, dark matter and dark energy. Alternate years. Prerequisites: PHYS 331 and 334. Course is offered occasionally.

PHYS 367. Introduction to Stellar and Galactic Astrophysics. (4 Credits)

Introduction to stellar and galactic astrophysics with an emphasis on the underlying physical principles. Course has an integrated lab component (2 hours lecture, 1 hour lab per week) Topics: Structure and evolution of stars, stellar atmospheres and spectra, binary stars and stellar remnants. Galactic dynamics, morphology, and evolution; large-scale structure of the universe. Prerequisites: MATH 333 and PHYS 334. Alternate years. Course is offered occasionally.

PHYS 494. Senior Seminar. (2 Credits)

Study of the wider cultural significance of physics including its historical development; its relationship to other disciplines; its philosophical interpretations; its place in a Christian worldview; and one's stewardship toward society. Independent study and classroom presentation.

Prerequisite: senior standing in the major. (lin)

General Education: SHAR

PHYS 495. Independent Study. (1 to 4 Credits)

Independent research.

PHYS 496. Internship. (1 to 4 Credits)

Supervised off-campus experience with departmental approval. Graded pass/fail. Prerequisite: junior or senior standing with Physics major.

PHYS 499. Honors Thesis. (2 or 4 Credits)

An independent project providing original physics research developed in a scholarly paper and culminating in an oral examination. Partially fulfills requirements for an honors degree in physics. Additional requirements are available in the Physics Office.