

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. Co or Prerequisite: MATH 231.

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. Co or Prerequisite: MATH 232

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.

Tags: SP

PHYS 311. 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 232.

PHYS 331. Spacetime & 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. Co or Prerequisite: MATH 245 and MATH 333.

PHYS 333. Thermal Physics & Fluids. (2 Credits)

An introduction to the thermodynamic principles of microstates, entropy, and heat engines as well as basic fluid mechanical concepts of buoyancy and fluid flow. Prerequisite: PHYS 232.

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. Prerequisites: PHYS 231 and MATH 231. Pre or Corequisite: MATH 232.

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. Prerequisites: PHYS 334 and MATH 333. Pre or Co-requisite: MATH 245 and MATH 331.

PHYS 342. Electromagnetic Theory. (4 Credits)

Electrostatics, steady currents, linear materials, electromagnetic induction, Maxwell's equations, and electromagnetic waves. Prerequisites: PHYS 334 and MATH 331. Pre or Corequisite: MATH 333. Alternate years.

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. Prerequisites: PHYS 334, MATH 331, MATH 245 and MATH 333. Alternate years.

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. 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.

PHYS 353. Introductory Optics. (2 Credits)

Electromagnetic and quantum mechanical theory of light, geometrical and physical optics, interference, diffraction, and optical instruments. Four hours lecture, three hours laboratory. Prerequisite: PHYS 334. Alternate years.

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. Prerequisite: PHYS 353. Alternate years.

PHYS 359. Thermodynamics. (4 Credits)

Theory of heat and gases, introduction to kinetic theory and statistical mechanics. Alternate years. Prerequisite: PHYS 333 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.

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.

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

Elementary particles, fundamental interactions, conservation laws and symmetries, big bang cosmology, dark matter and dark energy.
Prerequisite: PHYS 334. Alternate years.

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.

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)

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

Independent research.

PHYS 496. Internship. (2 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 to 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.