Physics (PHYS)

PHYS 1010. Elementary Physics PP. (3 Credits)
For students interested in a one-semester survey physics course. Covers the fundamentals of classical and modern physics. Includes mechanics, fluids, heat, waves and sound, electricity and magnetism, light, optical, relativity, atomic and nuclear physics. Includes lectures, classroom interaction, demonstration, and problem solving.
Canvas Course Mats $105/Pearson applies.

PHYS 1090. Pathways to Physics. (1 Credit)
Examines physics as a field of study. Introduces students to the UVU physics program and faculty research. Develops learning strategies specific to physics coursework and an awareness of available career paths in the sciences.

PHYS 1100. Introductory Math Techniques for Physics and Engineering. (3 Credits)
Prerequisite(s): Math 1050 or Math 1080
Is an application-oriented, hands-on introduction to physics and engineering mathematics. Teaches the tools needed to solve problems commonly encountered in the first two years of core physics and engineering courses. Presents topics within the context of a physics or engineering problem, and reinforces through extensive examples and computational tools taken from physics and engineering courses.

PHYS 1600. Introduction to Nanotechnology and Cleanroom Processes. (3 Credits)
Prerequisite(s): MATH 1050
Surveys the principles and processes behind nanotechnology and nanomaterials, basic tools for fabrication and characterization of nano and microstructures, and applications of nanotechnology. Examines fundamental principles and laws of electronics, atomic physics, solid-state physics and chemistry that are essential to nanotechnology will be introduced. Includes conducting virtual reality training exercises for tools such as electron microscopy, atomic force microscopy, nanolithography, and sputter deposition, and they will then complete hands-on laboratory experiments with these instruments. Covers special topics such as graphene, carbon nanotubes, quantum dots and molecular electronics.

PHYS 1700. Descriptive Acoustics PP. (3 Credits)
Prerequisite(s): MAT 1010 or higher
Introduces the science of sound, music and speech and the physical principles and technology used to manipulate, store and broadcast it.

PHYS 1750. The Acoustics of Music PP. (3 Credits)
Prerequisite(s): MAT 1010 or higher
Discovers the principles of physics that form the basis of music and provide the foundation for the design of musical instruments. Investigates the physics of music production, transmission and reception, and perception. Examines the five fundamental elements of the musical instrument, namely power supply, oscillator, resonator, amplifier, and pitch modifiers. Satisfies one general education physical science elective.

PHYS 1800. Energy You and the Environment PP. (3 Credits)
Prerequisite(s): MAT 1010 or higher
Answers the question, "Where does energy come from, and where does it go?". Examines the methods of energy production, distribution, and consumption in society and their environmental impacts. Examines the personal impact of energy use on the environment and explores alternatives, such as fuel cell cars, and a hydrogen economy. Examines prospects for alternative energy sources, such as solar, wind, nuclear and geothermal energy at length. Intended for non-science majors interested in energy use in society.

PHYS 1850. The Physics of Aviation PP. (3 Credits)
Prerequisite(s): MAT 1010 or higher
Uses the medium and modes of flight and modern aviation to introduce elementary physics. Includes vectors, kinematics, forces, momentum, energy, torques, elementary fluid dynamics and thermodynamics. Uses Algebra extensively. Presents and develops concepts of physics as exercises in modeling constructed from examples used in aviation.
Canvas Course Mats $81/Pearson applies.

PHYS 2010. College Physics I PP. (4 Credits)
Prerequisite(s): MATH 1050 or higher
Corequisite(s): PHYS 2015
For students desiring a two semester algebra based course in applied physics. Covers mechanics, fluids, waves, heat, and thermodynamics.
Canvas Course Mats $81/Pearson applies.

PHYS 2015. College Physics I Lab. (1 Credit)
Corequisite(s): PHYS 2010
Designed to accompany PHYS 2010. Provides firsthand experience with the laws of mechanics, fluids, waves, heat, thermodynamics, and data analysis.
Course Lab fee of $15 applies.

PHYS 2020. College Physics II PP. (4 Credits)
Prerequisite(s): PHYS 2010
Corequisite(s): PHYS 2025
A continuation of PHYS 2010. Covers electricity, magnetism, waves, sound, optics, and nuclear physics.
Canvas Course Mats $81/Pearson applies.

PHYS 2025. College Physics II Lab. (1 Credit)
Corequisite(s): PHYS 2020
Designed to accompany PHYS 2020. Provides firsthand experience with the laws of electricity, waves, optics, nuclear physics, and data analysis.
Course Lab fee of $15 applies.

PHYS 2210. Physics for Scientists and Engineers I PP. (4 Credits)
Prerequisite(s): MATH 1210 or PHYS 1100
Corequisite(s): PHYS 2215
Introduces mechanics, fluid dynamics, thermodynamics, vibrations, and waves to the budding scientist or engineer utilizing the quantitative tools of calculus. Includes 1 hour of recitation per week.

PHYS 2215. Physics for Scientists and Engineers I Lab. (1 Credit)
Corequisite(s): PHYS 2210
Designed to accompany PHYS 2210. Provides firsthand experience with the laws of mechanics, thermal physics, vibrations, and waves. Introduces methods of scientific data analysis.
Course Lab fee of $15 applies.

PHYS 2220. Physics for Scientists and Engineers II PP. (4 Credits)
Prerequisite(s): PHYS 2210
Corequisite(s): PHYS 2225
Continues from PHYS 2210. Covers electricity and magnetism, including Maxwell's equations. Develops the theory of electromagnetic waves and optics. Presents introductory electronics and modern physics topics. Includes one hour of recitation.

PHYS 2225. Physics for Scientists and Engineers II Lab. (1 Credit)
Corequisite(s): PHYS 2220
Accompanies PHYS 2220. Provides students first hand experience with the laws of electricity and magnetism, electric circuits, and optics. Emphasizes principles of data collection and analysis.

PHYS 2500. Elementary Fluids and Thermal Physics. (3 Credits)
Prerequisite(s): PHYS 2220
Corequisite(s): MATH 2210
Presents a mathematically rigorous introductory description of fluid mechanics, thermodynamics, and heat transfer beyond that presented in PHYS 2210. Presents applications in both physics and engineering.

PHYS 2700. Biophysics. (3 Credits)
Prerequisite(s): PHYS 2220, PHYS 2225, and BIOL 1010 or BIOL 1610
Covers the thermodynamics and statistical mechanics of biological systems, the mechanics of biologically important molecules, and the laws of fluid mechanics as applied in biological systems. Uses calculus-based mathematical models to treat specific reactions, particularly those treating biological systems as molecular machines.

PHYS 2800. Introduction to Materials Physics. (3 Credits)
Prerequisite(s): PHYS 2220
Covers the atomic structure of materials and their properties, including electronic, thermal, and optical properties. Addresses experimental methods for creating and studying materials, and current topics in materials science including thin films, surface physics, metamaterials, and nanostructured materials.

PHYS 295R. Introduction to Independent Research. (1-3 Credits)
Prerequisite(s): PHYS 2210, Departmental Approval
Working under faculty supervision, allows research on a project determined jointly with a faculty member and approved by the department chair. Emphasizes experimental technique, data collection, modeling, and analysis techniques. May be repeated for no more than six hours of elective credit.

PHYS 3010. Physics Experiments for Secondary Education. (1 Credit)
Prerequisite(s): PHYS 2210, (MATH 1050 or MATH 1055), MATH 1210, PHYS 2220, MATH 1060, and University Advanced Standing
For secondary education students. Emphasizes physics or chemistry. Addresses pedagogical methods for student physics laboratory exercises and demonstrations. Studies currently available commercial laboratory equipment for teaching physics in a lab setting. Includes ideas and methods for building inexpensive demonstrations and lab exercises. Provides training in safe and effective use of lab equipment.

PHYS 3040. Modern Physics for Secondary Education. (3 Credits)
Prerequisite(s): PHYS 2220, MATH 1220, and University Advanced Standing
Addresses topics of special relativity, development of quantum mechanics, physics of the atom, elementary solid state physics, and elementary particle physics.

PHYS 3110. Modern Physics I. (3 Credits)
Prerequisite(s): PHYS 2220 and University Advanced Standing
Corequisite(s): PHYS 3115
Addresses topics of error analysis and statistics, wave mechanics, special relativity, development of quantum mechanics, and atomic physics.

PHYS 3115. Introduction to Experimental Physics I WE. (2 Credits)
Prerequisite(s): PHYS 2220 and University Advanced Standing
Corequisite(s): PHYS 3110
Introduces selected experiments of classical and modern physics in a laboratory setting. Addresses topics of measurement, error analysis, data analysis, and report writing.

PHYS 3120. Modern Physics II. (3 Credits)
Prerequisite(s): PHYS 3110 and University Advanced Standing
Corequisite(s): PHYS 3125
Covers topics in special and general relativity, and addresses applications of modern quantum mechanics including molecular physics, solid state physics, statistical mechanics, nuclear physics, particle physics, and cosmology.

PHYS 3125. Introduction to Experimental Physics II WE. (2 Credits)
Prerequisite(s): PHYS 3110, PHYS 3115, and University Advanced Standing
Pre- or Corequisite(s): PHYS 3120
Introduces selected experiments of classical and modern physics in a laboratory setting. Addresses topics of measurement, data analysis, report writing.

PHYS 3230. Principles of Electronics for the Physical Sciences. (3 Credits)
Prerequisite(s): PHYS 2220, MATH 2210, and University Advanced Standing
Introduces electronic measurement instruments commonly used in experimental physics laboratories. Covers principles of electronic measurements using transducers, solid-state devices, circuit analysis, logic circuits, and computers. Includes lab experience. Course lab fee of $45 for materials applies.

PHYS 3300. Mathematical Physics. (3 Credits)
Prerequisite(s): PHYS 2220, and University Advanced Standing
Pre- or Corequisite(s): MATH 2210 or instructor consent. MATH 2280 is strongly advised as a pre- or corequisite.
Covers the applications of mathematical tools to experimental and theoretical research in the physical sciences. Introduces problems and systems common to physical science that can be modeled by the application of vector and tensor algebra, curvilinear coordinates, linear algebra, complex variables, Fourier series and transforms, differential and integral equations.

PHYS 3310. Advanced Mathematical Physics. (3 Credits)
Prerequisite(s): PHYS 3300 and University Advanced Standing
Explores mathematics as applied to physics. Covers many families of orthogonal polynomials and the special functions of physics, such as the Gamma, Beta, and Error functions. Presents topics in contour integration and applications of conformal mapping. Investigates probability, random processes, statistical analyses, and probability distribution functions.

PHYS 3330. Computational Physics. (3 Credits)
Prerequisite(s): PHYS 3300 and University Advanced Standing
Covers computational algorithms with specific applications to the description of physical systems. Covers iterative approximation methods, computations using matrices and vectors, numerical integration, solutions of differential equations. Uses a computer programming approach to problem solving.

PHYS 3350. Applications of LabVIEW in Physics. (3 Credits)
Prerequisite(s): PHYS 3230 and University Advanced Standing
Develops programming skills in LabVIEW. Utilizes LabVIEW as the primary interface for analog and digital I/O for applications in physics experiments. Includes a student-directed group project that demonstrates effective use of LabVIEW in hardware interfacing in a physics experiment.

PHYS 3400. Classical Mechanics. (3 Credits)
Prerequisite(s): PHYS 2220 and University Advanced Standing
Pre- or Corequisite(s): PHYS 3300 recommended
Treats classical mechanics of particles and systems using advanced mathematical techniques. Covers conservation principles, Lagrangian dynamics, harmonic oscillators, motion of rigid bodies and non-inertial reference frames.

PHYS 3500. Thermodynamics. (3 Credits)
Prerequisite(s): PHYS 2220, MATH 2210, and University Advanced Standing
Addresses topics of heat, temperature, ideal gases, laws of thermodynamics, entropy, reversibility, thermal properties of solids, phase transitions, thermodynamics of magnetism, and negative temperature.

PHYS 3600. Optics. (3 Credits)
Prerequisite(s): PHYS 3300, PHYS 3110, and University Advanced Standing
Covers the phenomena of reflection, refraction, diffraction, interference, optical behavior in materials and lasers. Presents a mathematically rigorous description of optical phenomena. May Include equipment-based class projects.

PHYS 3700. Particle Physics. (3 Credits)
Prerequisite(s): PHYS 3110 and University Advanced Standing
Introduces the Standard Model of particle physics, which enumerates the elementary particles that make up the universe and describes their interactions. Addresses particle accelerators and detectors. Examines unresolved questions in particle physics and possible extensions to the Standard Model.

PHYS 3800. Energy Use on Earth. (3 Credits)
Cross-listed with: CHEM 3800, ENVT 3800
Prerequisite(s): (PHYS 1010 or PHSC 1000 or GEO 1010 or GEO 2040 or METO 1010) and (MATH 1050 or MATH 1055) and CHEM 1010 and University Advanced Standing
Covers the science of energy production and consumption. Quantitatively analyzes various methods of energy production, distribution, and end use in all sectors of our society, including transportation, residential living, and industry. Examines the impacts of our energy consumption on the environment and prospects for alternative energy sources. Is intended for science majors interested in energy use in society or in an energy related career, and for students in other majors who feel that a technical understanding of energy use will help them to understand and mitigate its impact in our society.

PHYS 4150. Medical Physics. (3 Credits)
Prerequisite(s): PHYS 3110, PHYS 3115 and University Advanced Standing
Explores the theory and applications of physics to medicine. Covers signal analysis, ultrasound, X-rays, optical, nuclear, and X-ray imaging techniques, nuclear medicine, magnetic resonance imaging, and nanomedicine.

PHYS 4210. Advanced Experimental Techniques. (3 Credits)
Prerequisite(s): (PHYS 3125, PHYS 3230, or instructor approval) and University Advanced Standing
Introduces students to the process of developing, designing, proposing, building, executing, analyzing, revising, and presenting a scientific experiment. Teaches a variety of advanced experimental technical skills and helps students learn to embark independently on scientific research.

PHYS 4250. Nuclear Physics. (3 Credits)
Prerequisite(s): PHYS 3110
Covers radiation, radioactive decay, nuclear structure, interactions of radiation with matter, radiation detection, nuclear reactions, fission, fusion, and applications of nuclear physics.

PHYS 425R. Physics for Teachers. (1-5 Credits)
Prerequisite(s): Department Approval and University Advanced Standing
For licensed teachers or teachers seeking to recertify, an update course in physics and/or basic physics core courses for teachers needing physics or physical science endorsements from the Utah State Office of Education. Teaches principles of physics and pedagogy of teaching physics for teachers in public or private schools. Emphasis will be placed on correlation with the Utah Core Curriculum, the National Science Education Standards, and the Benchmarks of Project 2061. Topics will vary.

PHYS 4350. Research Methods in Physics. (3 Credits)
Prerequisite(s): Instructor and Department approval and University Advanced Standing
Presents directed topics in research methods. Emphasizes practical methodologies in measurement, instrumentation, error analysis, statistical analysis and computational modeling. Requires a class project that may require MATLAB, LABView or other programming languages. Includes producing oral presentations, posters and journal articles using contemporary software and LaTeX.

PHYS 4410. Electrostatics and Magnetism. (3 Credits)
Prerequisite(s): PHYS 3110, PHYS 3115, PHYS 3300, and University Advanced Standing
Explores the theory of electrostatic phenomena in a mathematically rigorous manner. Covers Gauss' Law, the Laplace and Poisson equations, boundary-value problems, and dielectrics.

PHYS 4420. Electrodynamics. (3 Credits)
Prerequisite(s): PHYS 4410 and University Advanced Standing
Explores the theory of electrodynamic phenomena in a mathematically rigorous manner. Covers Ohm's and Kirchhoff's Laws, magnetic induction, the Biot- Savart Law, Ampere's Law, Ferromagnetism, Plasmas, Maxwell's Equations, and Special Relativity.

PHYS 4510. Quantum Mechanics I. (3 Credits)
Prerequisite(s): PHYS 3110, PHYS 3115, PHYS 3300, and University Advanced Standing
Covers postulates of quantum mechanics, state functions of quantum systems, Hermitian Operators, the Schrodinger Equation, eigenfunctions of harmonic oscillators, and particles in potential wells.

PHYS 4520. Quantum Mechanics II. (3 Credits)
Prerequisite(s): PHYS 4510 and University Advanced Standing
Covers general principles and applications of quantum mechanics. Addresses topics of three-dimensional problems, angular momentum operators, spin wavefunctions, perturbation theory, applications to atomic, molecular, solid-state, and nuclear physics.

PHYS 4700. Acoustics. (3 Credits)
Prerequisite(s): PHYS 3110, PHYS 3115, PHYS 3300, and University Advanced Standing
Covers phenomena of sound, resonance, acoustics, and human hearing. Treats associated topics of waves, frequency, vibration and interference using appropriate mathematical tools.

PHYS 4800. Solid State Physics. (3 Credits)
Prerequisite(s): PHYS 3120, 3125, PHYS 4510, and University Advanced Standing
Explores topics relevant to the structure, behavior, and properties of crystalline materials. Includes a study of lattice vibrations, free electrons, semiconductors, superconductivity, dielectric and ferroelectric materials and magnetism.

PHYS 481R. Physics Internship. (1-4 Credits)
Prerequisite(s): PHYS 2220, Departmental Approval, and University Advanced Standing
Provides supervised, practical, and research experience for students preparing for careers in physics. May be repeated for a maximum of 6 credit hours. May be graded credit/no credit.

PHYS 489R. Undergraduate Research in Physics. (1-3 Credits)
Prerequisite(s): PHYS 2220, Departmental Approval, and University Advanced Standing
Allows research on a project determined jointly with a faculty member and approved by the department chair. Emphasizes experimental technique, data collection, modeling, and analysis techniques. May be used as part of a senior thesis. May be repeated for a maximum of 9 credits toward graduation.

PHYS 490R. Seminar. (0.5 Credits)
Prerequisite(s): University Advanced Standing
Exposes students to current research topics in physics and related fields. Provides an opportunity for students to attend bi-weekly lectures presented by department faculty and invited speakers. Lectures are usually a summary of the speaker's recent research results presented at a level appropriate for junior and senior physics majors.

PHYS 492R. Topics in Physics. (3 Credits)
Prerequisite(s): Departmental approval and University Advanced Standing
Studies a chosen topic in physics. Topics vary depending upon student demand. Possible topic may be the mathematics for quantum mechanics. May be taken for a maximum of 6 credits toward graduation, but is limited to 3 credits for the BS in Physics.

PHYS 495R. Independent Readings. (1-3 Credits)
Prerequisite(s): PHYS 2220, Departmental Approval, and University Advanced Standing
Working under faculty supervision, allows research on a project determined jointly with a faculty member and approved by the department chair. Emphasizes experimental technique, data collection, modeling, and analysis techniques. May be used as part of a senior thesis. May be repeated for a maximum of 9 credits toward graduation.

PHYS 499A. Senior Project. (2 Credits)
Prerequisite(s): Instructor approval, Departmental approval, and University Advanced Standing
Provides an opportunity for senior physics majors to participate in a current research project supervised by a department faculty member. Includes independent study and/or laboratory work as necessary. Culminates in the preparation of a written paper and oral presentation describing the results of the research project as required for PHYS 499B. May be taken concurrently with PHYS 499B.

PHYS 499B. Senior Thesis. (1 Credit)
Prerequisite(s): Instructor approval, Departmental approval, and University Advanced Standing
Continues PHYS 499A. Provides an opportunity for senior physics majors to present the results of a current research project supervised by a department faculty member. Includes independent study as necessary. Culminates in the preparation of a written paper and oral presentation describing the results of the research project.