PHYSICS (PHYS)

PHYS 100 Energy 3 Hours
A one-semester survey of the concepts of energy applicable to the understanding of energy in our environment. Topics covered are the nature of energy, sources, transmission, consumption, energy and the environment, and prospects for the future. Experiments will be conducted as part of the classroom work. **Colonnade/Statewide General Education Code E-NS | NS**
Recent Term(s) Offered: None

PHYS 101 Concepts of Motion 3 Hours
A one-semester introduction to motion and matter. Topics include the analysis of motion, Newton's Laws of motion, work, energy, the structure and properties of solids, liquids and gases, wave motion and sound. Laboratory experiments are an integral part of this course. **Colonnade/Statewide General Education Code E-SL, E-NS | NS, SL**
Recent Term(s) Offered: None

PHYS 103 Light, Color and Vision 3 Hours
A descriptive account of the nature and properties of light, color and the process of seeing including descriptions of some important optical instruments, such as the eye, the camera and the telescope. Laboratory experiments are an integral part of the course. **Colonnade/Statewide General Education Code E-SL, E-NS | SL, NS**
Recent Term(s) Offered: spring 2022; fall 2022; spring 2023; fall 2023; spring 2024; fall 2024

PHYS 105 Concepts of the Physical World 3 Hours
A one-semester introduction to the concepts of physics for students planning to teach in elementary and middle schools. Topics include structure and properties of matter, mechanics, electricity, magnetism, heat, light and sound. Laboratory experiments are an integral part of this course. **Colonnade/Statewide General Education Code SL, NS**
Recent Term(s) Offered: None

PHYS 130 Acoustics of Music and Speech 3 Hours
The fundamental laws of mechanics and wave motion are studied with particular emphasis being placed upon their application to the production and control of music and speech. Laboratory experiments and field trips are an integral part of the course. Does not count toward credit for the physics major or minor. **Colonnade/Statewide General Education Code E-SL, E-NS | NS, SL**
Recent Term(s) Offered: spring 2022; fall 2022; spring 2023; fall 2023; spring 2024; fall 2024

PHYS 170 Introduction to the Physics Major 1 Hour
This course is the first of a two semester sequences of courses designed to introduce students to what is involved in pursuing a Physics major at WKU and to aid them in their transition to college.
Recent Term(s) Offered: fall 2024

PHYS 171 Exploring the Physics Major 1 Hour
This course is the second of a two semester sequences of courses designed to introduce students to what is involved in pursuing a Physics major at WKU and to help aid them in their transition to college.
Prerequisite(s): PHYS 170 with a minimum grade of P
Recent Term(s) Offered: None

PHYS 180 Introductory Modern Physics 3 Hours
A survey of the physics revolution responsible for laptop computers, fiber optics, and nuclear power. Follows the change in physical theory from the 1870's through the 1920's, from the geometrical optics and thermodynamics through the theories of relativity and the basic ideas behind quantum mechanics. **Colonnade/Statewide General Education Code E-NS | NS**
Prerequisite(s): (MATH 117 or MATH 118 or MA 117C or MATH 136 or MATH 137)
Corequisite(s): PHYS 181
Recent Term(s) Offered: fall 2022; fall 2023; fall 2024

PHYS 181 Introductory Modern Physics Laboratory 1 Hour
Laboratory experience focusing on applications of optics, thermodynamics, the structure and behavior of atoms, wavelike properties of particles, and quantization of light, charge and energy. **Colonnade/Statewide General Education Code E-SL | SL**
Prerequisite(s): (MATH 117 or MATH 118)
Corequisite(s): PHYS 180
Recent Term(s) Offered: fall 2022; fall 2023; fall 2024

PHYS 201 College Physics I 4 Hours
An introductory course for students majoring in applied sciences, emphasizing the application of basic physics principles through problem solving. Topics covered include mechanics, heat and thermodynamics, properties of matter and waves. Includes both lecture and laboratory components (No calculus is used). Note: High School algebra, geometry and right triangle trigonometry required. **Colonnade/Statewide General Education Code E-SL, E-NS | SL, NS**
Recent Term(s) Offered: fall 2022; fall 2023; fall 2024

PHYS 215 Seminar for Physics Learning Assistants 1 Hour
Introduces students to basic theory and practical skills for assisting instructors as learning assistants in active-engagement physics courses. Note: A college level physics course and acceptance to serve as a learning assistant or permission of instructor.
Recent Term(s) Offered: spring 2022; fall 2022; fall 2023; spring 2024; fall 2024

PHYS 231 Introduction to Physics and Biophysics I 3 Hours
The first half of a basic course for students of the life sciences, covering the topics of mechanics, heat and thermodynamics, properties of matter, waves and sound. Emphasis is on an understanding of the physical principles operative in biological systems and on the application of physical methods in biology and medicine. Note: High School algebra, geometry and right triangle trigonometry required. **Colonnade/Statewide General Education Code E-NS | NS**
Corequisite(s): PHYS 232
Recent Term(s) Offered: spring 2022; fall 2022; spring 2023; fall 2023; spring 2024; fall 2024

PHYS 232 Laboratory for Physics and Biophysics I 1 Hour
Students perform physics experiments on mechanics, fluids, sound, heat and thermodynamics. **Colonnade/Statewide General Education Code E-SL | SL**
Corequisite(s): PHYS 231
Recent Term(s) Offered: spring 2022; fall 2022; spring 2023; fall 2023; spring 2024; fall 2024

PHYS 233 Laboratory for Physics and Biophysics II 1 Hour
Students perform physics experiments in electricity, magnetism and optics.
Corequisite(s): PHYS 332
Recent Term(s) Offered: spring 2022; fall 2022; spring 2023; fall 2023; spring 2024; fall 2024

PHYS 255 University Physics I 4 Hours
This is the first half of a year-long course in calculus-based physics suggested for students in the physical sciences and mathematics. Definitions, concepts, and problem solving will be emphasized. Topics include kinematics, dynamics, energy, conservation laws, rotation, harmonic motion, mechanical waves and thermodynamics. **Colonnade/Statewide General Education Code E-NS | NS**
Prerequisite(s): MATH 136 with a minimum grade of C and MATH 137 (may be taken concurrently)
Corequisite(s): PHYS 256
Recent Term(s) Offered: spring 2022; fall 2022; spring 2023; fall 2023; spring 2024; fall 2024

PHYS 256 University Physics I Lab 1 Hour
Students perform physics experiments in mechanics and thermodynamics which stress the fundamental definitions and laws developed in the lecture course. Students gain experience in computerized data acquisition and data analysis using modern techniques and equipment. **Colonnade/Statewide General Education Code E-SL | SL**
Corequisite(s): PHYS 255
Recent Term(s) Offered: spring 2022; fall 2022; spring 2023; fall 2023; spring 2024; fall 2024

PHYS 265 University Physics II 4 Hours
This is the second half of a year-long course in calculus-based physics suggested for students in the physical sciences and mathematics. Definitions, concepts, and problem solving will be emphasized. Topics include electricity and magnetism, (electric and magnetic fields, forces, energy, potential, charged particle motion, induction, and circuits), sound waves and optics.
Prerequisite(s): (PHYS 255 with a minimum grade of C and MATH 227 with a minimum grade of C or MATH 137 with a minimum grade of C)
Corequisite(s): PHYS 266
Recent Term(s) Offered: spring 2022; fall 2022; spring 2023; fall 2023; spring 2024; fall 2024

PHYS 266 University Physics II Laboratory 1 Hour
Students perform physics experiments in electricity and magnetism, waves and optics which stress the fundamental definitions and laws developed in the lecture course. Students gain experience in computerized data acquisition and data analysis using modern techniques and equipment.
Prerequisite(s): PHYS 255 and MATH 137
Corequisite(s): PHYS 265
Recent Term(s) Offered: spring 2022; fall 2022; spring 2023; fall 2023; spring 2024; fall 2024

PHYS 295 Introduction to Research Methodology 1 Hour
To familiarize Ogden Research Scholars and other research oriented students with the fundamentals of choosing a research topic, performing a bibliographical search on a subject, topic, classification of instruments, data taking, data reduction, professional ethics and other research oriented topics. The common points of research methodology in the different scientific areas will be accentuated. Examples will be drawn from the various disciplines. Use of computers will be emphasized. (Course does not count towards any major or minor.) Note: Ogden Research Scholar, or 3.2 grade point average at the end of freshman year, or Ogden College faculty member recommendation.
Equivalent(s): CHEM 295, MATH 295, CS 295, BIOL 295, ENGR 295
Recent Term(s) Offered: None

PHYS 299 Research Experiences 1-3 Hours (repeatable max of 3 hrs)
Individual or group research project carried out under direct faculty supervision. A faculty approved public presentation is required. Note: Permission of instructor required.
Prerequisite(s): MATH 117 and (PHYS 180 or PHYS 201 or PHYS 231 or PHYS 255)
Recent Term(s) Offered: spring 2022; fall 2022; spring 2023; fall 2023; spring 2024; summer 2024; fall 2024

PHYS 301 Electrical Measurements Laboratory 1 Hour
Laboratory experiments in fundamental techniques of electrical measurements.
Prerequisite(s): PHYS 265 and PHYS 266
Recent Term(s) Offered: spring 2022; spring 2023; spring 2024

PHYS 302 Atomic Physics Laboratory 1 Hour
Fundamental experiments of historical importance in modern physics.
Prerequisite(s): PHYS 321 (may be taken concurrently)
Recent Term(s) Offered: fall 2022; fall 2023; fall 2024

PHYS 316 Computational Physics 3 Hours
Use of computers to solve physics problems, model physical systems, and analyze data. Topics include simulating realistic motion, data analysis, Fourier transform, solutions to Laplace's equation, and Monte Carlo methods. Note: Permission of instructor may be required.
Prerequisite(s): PHYS 321
Recent Term(s) Offered: spring 2022; spring 2023; spring 2024

PHYS 318 Data Acquisition Using Labview 3 Hours
A study of computer-assisted measurement and automation techniques. Students receive hands-on experience in measuring and controlling physical phenomena through laboratory exercises and projects. Recognized as a LabVIEW Academy course by National Instruments. Offers students the opportunity to become Certified LabVIEW Associate Developers. Note: Permission of instructor may be required.
Prerequisite(s): PHYS 301 with a minimum grade of C or ME 310 with a minimum grade of C or EE 211 with a minimum grade of C
Recent Term(s) Offered: winter 2022; fall 2022; fall 2023; fall 2024

PHYS 321 Introductory Modern Physics II 3 Hours
Study of the breakdown of classical physics at velocities close to the speed of light and on atomic scales. Topics include relativistic kinematics and dynamics, wave/particle duality, the Schrodinger equation, square wells, harmonic oscillators, the hydrogen atom, many-electron atoms, statistical distribution laws, conductivity and superconductivity, the band theory of solids, nuclear structure and reactions, and other selected topics of modern physics.
Prerequisite(s): PHYS 180 and PHYS 265 and MATH 237 (may be taken concurrently) and CHEM 120 (may be taken concurrently)
Recent Term(s) Offered: fall 2022; spring 2023; spring 2024

PHYS 330 Thermodynamics 3 Hours
A study of thermodynamic systems, equations of state, entropy, Maxwell-Bolzmann and quantum statistics.
Prerequisite(s): PHYS 321 and MATH 237 and MATH 331
Recent Term(s) Offered: spring 2022; spring 2023; spring 2024

PHYS 332 Introduction to Physics and Biophysics II 3 Hours
The second half of a basic course for students of the life sciences, covering the topics of electricity, magnetism, light optics, atomic and nuclear physics. Emphasis is on an understanding of the physical principles operative in biological systems and on the application of physical methods in biology and medicine.
Prerequisite(s): PHYS 231
Corequisite(s): PHYS 233
Recent Term(s) Offered: spring 2022; fall 2022; spring 2023; fall 2023; spring 2024; fall 2024

PHYS 335 General Biophysics 4 Hours (repeatable max of 4 hrs)
An introduction to the major fields of biophysics in quantitative terms, with emphasis on the physical techniques applied in biomedical practice and research. Note: Permission of instructor may be required.
Prerequisite(s): PHYS 231 and PHYS 332 and BIOL 120 and BIOL 121
Recent Term(s) Offered: None

PHYS 337 Medical Imaging 4 Hours
An introduction to the fundamental and quantitative principles underlying major medical imaging techniques.
Prerequisite(s): BIOL 120 and MATH 136 and (PHYS 332 or PHYS 265)
Recent Term(s) Offered: None

PHYS 350 Classical Mechanics I 3 Hours
A study of classical mechanics including equations of motion, coordinate systems, the simple harmonic oscillator, damping forces, vector algebra, momentum and energy theorems.
Prerequisite(s): MATH 237 (may be taken concurrently) and MATH 331 (may be taken concurrently) and PHYS 265
Recent Term(s) Offered: fall 2022; fall 2023; fall 2024

PHYS 359 Clinical Optics 4 Hours
The optics of the human eye and of corrective lenses for common eye defects.
Prerequisite(s): PHYS 332 and PHYS 233
Recent Term(s) Offered: fall 2022; fall 2024

PHYS 363 Science Controversies: Historical and Contemporary 3 Hours
Examine the historical and contemporary scientific conflicts within their social and cultural contexts to better understand and communicate across different scientific and cultural paradigms. **Colonnade/Statewide General Education Code K-SC**
Prerequisite(s): 21 hours of Foundations and Explorations Courses, or junior status
Recent Term(s) Offered: fall 2022; fall 2023; fall 2024

PHYS 379 Nanotechnology in Biophysics and Medicine 4 Hours
The physics of nanostructures and thier bio-medical applications.
Prerequisite(s): (PHYS 332 and PHYS 233) or (PHYS 265 and PHYS 266)
Recent Term(s) Offered: spring 2022; spring 2024

PHYS 389 Practicum in Physics and Astronomy 3-6 Hours (repeatable max of 12 hrs)
Practical experience in a supervised work situation. Application of basic knowledge and skills from the student's major discipline or area of career interest, with opportunities in learning the social, psychological, cultural and communication aspects of work. The student is placed under the direction of a supervisor of a cooperating business, industry, agency or institution. Includes specific, learning objectives and evaluation of the student using one or more of the following formats: (1) written reports, (2) seminar presentations, or (3) tests over selected readings. May be repeated with departmental approval.
Recent Term(s) Offered: None

PHYS 398 Junior Seminar 0.5 Hours (repeatable max of 1 hrs)
Weekly seminar series in current topics in physics. Each student will also prepare for and take comprehensive examination in physics.
Prerequisite(s): PHYS 321 and PHYS 350
Recent Term(s) Offered: spring 2022; spring 2023; spring 2024

PHYS 399 Research Problems in Physics and Astronomy 1-3 Hours (repeatable max of 12 hrs)
Assigned reading or research for qualified undergraduates. May be repeated with change of content, but only three hours will count toward a major.
Prerequisite(s): PHYS 321
Recent Term(s) Offered: fall 2022; spring 2023; summer 2023; fall 2023; spring 2024

PHYS 404 Optics Laboratory 1 Hour
Fundamental laboratory experiments in geometrical and physical optics. Note: Required laboratory for students enrolled in PHYS 441.
Corequisite(s): PHYS 441
Recent Term(s) Offered: spring 2022; spring 2024

PHYS 406 Lab / Solid State 1 Hour
Fundamental laboratory experiments in solid state physics.
Corequisite(s): PHYS 460
Recent Term(s) Offered: fall 2023

PHYS 407 Nuclear Physics Lab 1 Hour
Fundamental lab experiments in nuclear physics.
Corequisite(s): PHYS 470
Recent Term(s) Offered: None

PHYS 413 Physics Teaching Seminar: Laboratories 1 Hour
This course develops pedagogical content knowledge and skills for teaching introductory physics laboratory at any level, particularly 7-12 grade. Topics include laboratory pedagogical frameworks such as confirmation labs, guided discovery labs, open-ended labs, and skill-focused labs. The class will be taught in an interactive, hands-on format to allow students to build necessary skills to teach laboratories in traditional, informal, virtual, and computational environments. May be counted as a restricted elective for a physics major or minor that is obtaining teaching certification.
Prerequisite(s): PHYS 231 with a minimum grade of C or PHYS 255 with a minimum grade of C
Recent Term(s) Offered: None

PHYS 415 Physics Teaching Seminar: Forces and Interactions 1 Hour
Course developing pedagogical content knowledge for teaching introductory physics at any level, particularly 7-12 grade. Topics related to forces and interactions, including kinematics, Newton's laws, and forces (mechanical, electrical, and magnetic). The class will be taught in an interactive, hands-on format in an investigative environment to allow students to build physics concepts through practicing them. May be counted as a restricted elective for a physics major or minor that is obtaining teaching certification.
Prerequisite(s): PHYS 231 with a minimum grade of C or PHYS 255 with a minimum grade of C
Recent Term(s) Offered: spring 2023

PHYS 416 Physics Teaching Seminar: Momentum and Energy 1 Hour
Course developing pedagogical content knowledge for teaching introductory physics at any level, particularly 7-12 grade. Topics related to momentum and energy, including impulse and momentum, work and energy, conservation of energy, energy transfer and relationship between energy and forces. The class will be taught in an interactive, hands-on format in an investigative environment to allow students to build physics concepts through practicing them. May be counted as a restricted elective for a physics major or minor that is obtaining teaching certification.
Prerequisite(s): PHYS 231 with a minimum grade of C or PHYS 255 with a minimum grade of C
Recent Term(s) Offered: fall 2023

PHYS 417 Physics Teaching Seminar: Waves, Electricity, and Magnetism 1 Hour
Course developing pedagogical content knowledge for teaching introductory physics at any level, particularly 7-12 grade. Topics related to waves and their applications, including vibration and waves, wave properties, sound waves and light waves, electricity, magnetism, and wave applications in modern technologies. The class will be taught in an interactive, hands-on format in an investigative environment to allow students to build physics concepts through practicing them. May be counted as a restricted elective for a physics major or minor that is obtaining teaching certification.
Prerequisite(s): PHYS 231 with a minimum grade of C or PHYS 255 with a minimum grade of C
Recent Term(s) Offered: spring 2024

PHYS 425 Physics of Materials Science 3 Hours
This course investigates the fundamental quantum physics of bonding, energetics and structure that underpins the foundation of the physics of materials. The physical properties of nanomaterials and their corresponding applications will be explored using the principles of quantum physics. Materials examined include engineered metal alloys, electronic and magnetic materials, ionic and network solids, ceramics, polymers, and biomaterials at all length scales.
Prerequisite(s): PHYS 321 and MATH 237 and MATH 331 (may be taken concurrently)
Recent Term(s) Offered: fall 2022; fall 2024

PHYS 431 Radiation Biophysics 4 Hours (repeatable max of 4 hrs)
A treatment of the properties of the various forms of radiation and their interaction with, and effects on, living matter. The laboratory offers training in the monitoring of ionizing radiations and in the techniques of radioactive isotopes as applied in biological and clinical work.
Prerequisite(s): (PHYS 201 and PHYS 202) or (PHYS 231 and PHYS 332)
Recent Term(s) Offered: None

PHYS 440 Electricity and Magnetism I 3 Hours
A study of classical electricity and magnetism with emphasis on fields, potentials, conductors, dielectrics, steady currents and radiation.
Prerequisite(s): PHYS 350 and MATH 237 and MATH 331
Recent Term(s) Offered: fall 2022; fall 2023; fall 2024

PHYS 441 Optics 3 Hours
A study of geometrical and physical optics including wave propagation, refraction, dispersion, diffraction and polarization.
Prerequisite(s): PHYS 180 and PHYS 265 and MATH 137
Corequisite(s): PHYS 404
Recent Term(s) Offered: spring 2022; spring 2024

PHYS 445 Electromagnetism II 3 Hours
The study of classical electrodynamics with emphasis on Maxwell's equations, electromagnetic waves, dispersion, and radiation.
Prerequisite(s): PHYS 440
Recent Term(s) Offered: spring 2022; spring 2024

PHYS 450 Classical Mechanics II 3 Hours
A study of rigid body motion, moving coordinate systems, Lagrange's equations, small vibrations and the special theory of relativity as applied to mechanics.
Prerequisite(s): PHYS 350 and MATH 237 and MATH 331
Recent Term(s) Offered: spring 2023

PHYS 460 Solid State Physics 3 Hours
An introductory course in the theory of solids including geometrical and x-ray crystallography, Maxwell-Boltzmann and Fermi-Dirac statistics, free electron theory of metals, Brillouin Zones, band-model of semiconductors and the Hall Effect.
Prerequisite(s): PHYS 321 and MATH 237 and MATH 331
Corequisite(s): PHYS 406
Recent Term(s) Offered: fall 2023

PHYS 465 Geophysics 3 Hours
The fundamentals of general and exploration geophysics. Topics include the origin of the earth and solar system, the earth's interior, geochronology, gravity and isostasy, seismology, the earth's heat, geomagnetism, upper atmosphere, continents and ocean basins, ridges and island arcs, and plate tectonics. The theory and applications of exploration geophysics are also covered, especially gravity, magnetic, and seismic methods. Note: One year of college physics or permission of instructor required.
Prerequisite(s): GEOL 111
Equivalent(s): GEOL 465
Recent Term(s) Offered: None

PHYS 470 Nuclear Physics 3 Hours
The properties of the nucleus including radioactivity, radiation detectors, nuclear reactions, nuclear mass and size determination, alpha, beta, and gamma decay, nuclear models, particle accelerators, fission and elementary particles.
Prerequisite(s): PHYS 302 and PHYS 321 and MATH 331
Corequisite(s): PHYS 407
Recent Term(s) Offered: None

PHYS 475 Selected Topics in Physics 1-3 Hours (repeatable max of 12 hrs)
Each topic is a course in directed study under the supervision of a faculty member. Available for full credit in subsequent sessions with change of content. Note: Permission of instructor is required.
Restriction(s): Students with a semester level of Academy Junior, Academy Senior, Freshman, Junior or Sophomore may **not** enroll.
Recent Term(s) Offered: fall 2022; fall 2024

PHYS 480 Quantum Mechanics 3 Hours
A study of the fundamental principles of quantum mechanics including the hydrogen and helium atoms, the harmonic oscillator, and the Schroedinger wave equation.
Prerequisite(s): PHYS 321 and PHYS 350 and MATH 237 and (PHYS 440 or PHYS 450 or MATH 435)
Recent Term(s) Offered: spring 2023

PHYS 489 Internship in Physics and Astronomy 3-6 Hours (repeatable max of 24 hrs)
Practical experience in a supervised work situation. Application of advanced knowledge and skills from the student's major discipline or area of career interest, with opportunities in learning the social, psychological, cultural, and communication aspects of work. The student is placed under the direction of a supervisor of a cooperating business industry, agency or institution. Includes specific learning objectives and evaluation of student using one or more of the following formats: (1) written reports, (2) seminar presentations, or (3) tests over selected readings. Note: May be repeated with departmental approval.
Recent Term(s) Offered: spring 2024; summer 2024; fall 2024

PHYS 498 Senior Seminar 0.5 Hours (repeatable max of 1 hrs)
Weekly seminar series in current topics in physics. Each student will also prepare and give an oral presentation of current research in physics.
Prerequisite(s): PHYS 398
Recent Term(s) Offered: fall 2022; fall 2023; fall 2024