PHYS 1500  Conceptual Physics  3 s.h.
A conceptual treatment of selected theories and laws of classical and modern
physics and their application to the understanding of natural phenomena.
The evolution of these laws from hypotheses to functional relationships
examined in a historical context. Not applicable to the major in Physics or to
the combined major in Physics and Astronomy.
Gen Ed: Natural Science.

PHYS 1500L  Conceptual Physics Laboratory  1 s.h.
Experimental work designed to supplement PHYS 1500. Three hours per week.
Prereq. or concurrent: PHYS 1500.

PHYS 1501  Fundamentals of Physics 1  4 s.h.
Topics include kinematics, forces, energy, momentum, rotational kinematics,
torque, angular momentum, simple harmonic motion, and mechanical waves.
Not recommended for mathematics, chemistry, physics, or engineering majors.
Prereq.: C or better in MATH 1507 or MATH 1510 and MATH 1511, or readiness
for MATH 1571 or equivalent, or at least level 40 on the Mathematics
Placement Test.
Gen Ed: Natural Science.

PHYS 1501L  Fundamentals of Physics Laboratory 1  1 s.h.
Experimental work designed to supplement the PHYS 1501, PHYS 1502
sequence. Three hours per week.
Prereq. or concurrent: PHYS 1501.

PHYS 1501R  Fundamentals of Physics 1 Recitation  1 s.h.
Discussion and problem solving based on current material in PHYS 1501.
Concurrent with: PHYS 1501.

PHYS 1502  Fundamentals of Physics 2  3 s.h.
Study of electricity, magnetism, and light. Topics include electric charge,
electric forces and fields, electric potential, capacitance and resistance in
direct current circuits, basic circuit analysis, magnetic forces and fields,
induced emf, inductance, reflections, refraction, geometric optics as applied to
lenses and mirrors, interference, and diffraction.
Prereq.: PHYS 1501 or equivalent.
Gen Ed: Natural Science.

PHYS 1502L  Fundamentals of Physics Laboratory 2  1 s.h.
Experimental work designed to supplement the PHYS 1501, PHYS 1502
sequence. Three hours per week.
Prereq. or concurrent: PHYS 1502.

PHYS 1506  Physics for Health Care  3 s.h.
The basic laws of physics applied to various biological and physiological
problems. Designed for majors in the allied health fields, e.g., Respiratory care.
Not applicable to the major in Physics or to the combined major in Physics and Astronomy.

PHYS 1507  Energy and the Environment  3 s.h.
Broad survey of the origin and distribution of the various forms of energy
found in nature. Examination of the physical laws governing society's use of
energy and environmental consequences resulting therefrom. Not applicable to
the major in Physics or to the combined major in Physics and Astronomy.

PHYS 1520H  Honors Perspectives in Physics  3 s.h.
Introduction to past and recent ideas in physics with specific emphasis on
their impact on historical and contemporary thought. The treatment, largely
non-mathematical, is enhanced by selected readings suitable for the beginning
honors student in any field. Not applicable to the major in Physics or to the
combined major in Physics and Astronomy.
Prereq.: Admission to the Honors Program or permission of instructor and
Director of Honors.

PHYS 2601  General Physics for Applied Medical Studies 1  4 s.h.
Description and analysis of motion including kinematics and dynamics of
translation and rotation; analysis of equilibrium, energy, and momentum of
objects; gravity; mechanical oscillations and waves. This course is designed
primarily for students enrolled in the NEO MED-YSU program or in pre-medical
curricula.
Prereq.: MATH 1507 and MATH 1508 or equivalent.
Prereq. or concurrent: MATH 1571, MATH 1581H, or MATH 1585H.
Gen Ed: Natural Science.

PHYS 2602  General Physics for Applied Medical Studies 2  4 s.h.
Description and analysis of electrical and magnetic effects; geometric and
physical optics and the wave nature of light; introduction to atomic physics,
quantum mechanics, nuclear structure and radiation.
Prereq.: PHYS 2601.
Gen Ed: Natural Science.

PHYS 2607  Physical Science for Middle and Secondary Education  4 s.h.
Selected topics in physical science appropriate to the middle- and secondary-
level curriculum. Emphasis on diverse hands-on classroom activities, and
multiple approaches to communicating basic concepts in physical science.
Topics include simple machines, light and sound, batteries and bulbs, physical
properties of solids, liquids and gases.
Prereq.: MATH 1501 or at least level 3 on the Mathematics Placement Test and
admission to BCOE upper-division status.
Gen Ed: Natural Science.

PHYS 2608  Sound  3 s.h.
The physical principles accounting for the production, propagation, and
perception of sound waves. The relevance of these principles to phenomena
ranging from hearing to the operation of various musical instruments.
Introduction to auditorium acoustics. This course is designed for Music
majors. Not applicable to the Physics major or to the combined Astronomy
and Physics major.
Gen Ed: Natural Science.

PHYS 2610  General Physics 1  4 s.h.
A course in mechanics; the kinematics and dynamics of masses in translation
and rotation; Newton's Laws; gravity; the conservation laws of energy and
momentum; simple harmonic motion and introduction to wave motion and
sound.
Prereq.: High school physics or PHYS 1501.
Prereq. or concurrent: MATH 1571.
Gen Ed: Natural Science.

PHYS 2610L  General Physics laboratory 1  1 s.h.
Experimental work designed to supplement the PHYS 2610, 2611 sequence.
Three hours per week.
Prereq. or concurrent: PHYS 2610 or PHYS 2601 for PHYS 2610L.

PHYS 2610R  General Physics 1 Recitation  1 s.h.
Discussion and problem solving based on current material in PHYS 2610.
Concurrent with: PHYS 2610.

PHYS 2611  General Physics 2  4 s.h.
Study of electric and magnetic fields and their effects; introduction to electric
circuits; light as an electromagnetic wave; introduction to geometrical and
physical optics.
Prereq.: PHYS 2610.
Prereq. or concurrent: MATH 1572.
Gen Ed: Natural Science.

PHYS 2611L  General Physics laboratory 2  1 s.h.
Experimental work designed to supplement the PHYS 2610, 2611 sequence.
Three hours per week.
Prereq. or concurrent: PHYS 2611 or PHYS 2602.
PHYS 3703 Classical Mechanics and Dynamics 4 s.h.
Prereq.: PHYS 2611 or ECEN 2633 and prerequisite or concurrent with MATH 3705.

PHYS 3704 Modern Physics 4 s.h.
Special Theory of Relativity. Quantum phenomena related to electromagnetic radiation and material particles. The Bohr model of the hydrogen atom; the Schrödinger equation; the Heisenberg Uncertainty Principle. Wave mechanics of single particles in one-dimensional potentials. Selected topics in atomic, nuclear and condensed matter physics.
Prereq.: PHYS 2611 or ECEN 2633 and prerequisite or concurrent with MATH 2673.

PHYS 3704L Modern Physics Laboratory 1 s.h.
Experimental work designed to supplement PHYS 3704. Three hours per week.
Prereq. or concurrent: PHYS 3704.

PHYS 3705 Thermodynamics and Classical Statistical Dynamics 3 s.h.
Principles and theorems of thermodynamics derived from the observable macroscopic properties related to temperature, heat, and the underlying statistical origins of thermodynamic processes. Includes the laws of thermodynamics, entropy, state functions, differential equations of state, Maxwell relations, and Maxwell-Boltzmann statistics.
Prereq.: PHYS 2611 or ECEN 2633 and prerequisite or concurrent with MATH 2673.

PHYS 3705L Thermodynamics and Classical Statistical Mechanics Laboratory 1 s.h.
Experimental work designed to supplement PHYS 3705. Three hours per week.
Prereq. or concurrent: PHYS 3705.

PHYS 3722 Advanced Optics and Light 3 s.h.
Sources and detection of light; intermediate geometrical and physical optics, including dispersion, scattering, absorption, polarization, coherence, interference, Fresnel and Fraunhofer diffraction.
Prereq.: MATH 2673 and either PHYS 2611 or ECEN 2633.

PHYS 3722L Advanced Optics Laboratory 1 s.h.
Experimental work designed to supplement PHYS 3722. Three hours per week.
Prereq. or concurrent: PHYS 3722.

PHYS 3730 Electronic Instrumentation 3 s.h.
Laboratory-based course in digital and analog electronics. Topics include AC and DC circuit theory; digital and analog electronics including filters, op amps, counters, digital integrated logic circuits, and A/D and D/A conversion; computer interfacing.
Prereq.: PHYS 2611.

PHYS 3741 Electromagnetic Field Theory 1 3 s.h.
Intermediate theory of electric and magnetic fields. Topics include electric field, scalar potential, techniques for calculating scalar potential (method of images, Laplace's and Poisson's equations, multipole expansion, Green's Function approach), dielectrics and polarization, Maxwell's equations and their application to the propagation of electromagnetic waves including reflection, refraction, transmission, and absorption; guided waves, retarded potentials, radiating systems, special relativity. Must be taken in sequence, before PHYS 3742.
Prereq.: MATH 3705 and either PHYS 2611 or ECEN 2633.

PHYS 3742 Electromagnetic Field Theory 2 3 s.h.
Intermediate theory of electric and magnetic fields. Topics include electric field, scalar potential, techniques for calculating scalar potential (method of images, Laplace's and Poisson's equations, multipole expansion, Green's Function approach), dielectrics and polarization, Maxwell's equations and their application to the propagation of electromagnetic waves including reflection, refraction, transmission, and absorption; guided waves, retarded potentials, radiating systems, special relativity.
Prereq.: PHYS 3741.

PHYS 3750 Mathematical Physics 3 s.h.
The mathematics techniques required in the study of classical, statistical, and quantum mechanics, and field theory.
Prereq.: MATH 3705 and either PHYS 2611 or ECEN 2633.

PHYS 4805 Undergraduate Physics Research 3 s.h.
Research conducted under the direction of a faculty member. The grading is Traditional/PR.
Prereq.: PHYS 3703 and PHYS 3704.
Gen Ed: Capstone.

PHYS 5810 Quantum Mechanics and Quantum Statistical Mechanics 1 3 s.h.
The postulates of wave mechanics, Matrix mechanics, angular momentum coupling, scattering, perturbation theory, intrinsic spin, emission and absorption of radiation. Fermi-Dirac and Bose-Einstein statistics with applications in quantum theory. Must be taken in sequence before PHYS 5811.
Prereq.: PHYS 3703 and PHYS 3704 and MATH 3705.

PHYS 5811 Quantum Mechanics and Quantum Statistical Mechanics 2 3 s.h.
The postulates of wave mechanics, Matrix mechanics, angular momentum coupling, scattering, perturbation theory, intrinsic spin, emission and absorption of radiation. Fermi-Dirac and Bose-Einstein statistics with applications in quantum theory. Must be taken in sequence.
Prereq.: PHYS 5810.

PHYS 5823 Laser Physics and Photonics 3 s.h.
Emission and absorption of radiation, including stimulated emission. Optical cavities and wave guides. Introduction to lasers. Modulation and detection of light. Applications of lasers to information processing and other technologies. Introduction to nonlinear optical and opto-electronic phenomena and nonlinear optical materials.
Prereq.: PHYS 3722.

PHYS 5826 Nuclear Physics 3 s.h.
General properties and behavior of the nucleus; nuclear models; nuclear reactions; radioactivity and decay processes; accelerators; current topics; elementary particles. Laboratory experiments. Prereq. PHYS 3704, PHYS 3704L, and MATH 3705.

PHYS 5830 Condensed Matter Physics 3 s.h.
Selected topics in condensed matter physics: mechanical, thermal, electrical, and magnetic properties of amorphous and crystalline materials; crystal structures.
Prereq.: PHYS 3704.

PHYS 5835 Spectroscopy 3 s.h.
Treatment of atomic, molecular, and nuclear structure based on the analysis of electromagnetic and other spectra.
Prereq.: PHYS 3704.

PHYS 5835L Spectroscopy Laboratory 1 s.h.
Experimental work designed to supplement PHYS 5835. Three hours per week.
Prereq. or concurrent: PHYS 5835.

PHYS 5850 Special Topics in Physics 2-4 s.h.
The study of a standard topic at greater depth, of the development of a correlated background for areas of physical knowledge, or the physical and educational experimentation necessary to develop new physics courses. May be repeated twice.
Prereq.: Senior standing in Physics, Electrical Engineering, or Education.

PHYS 5890 Physics and Astronomy for Educators 1-4 s.h.
Intensive study of selected topics of current interest in physics education. Not applicable to the major in Physics or the combined Astronomy and Physics major. May be repeated for different topics.
Prereq.: Admission to upper-division status in the College of Education or to the Graduate School.

PHYS 6900 Physics Education Workshop 1-3 s.h.
Intensive study of selected topics of current interest in physics education. May be repeated. Grading is S/U.
PHYS 6930  Semiconductor Materials and Devices  3 s.h.
Material properties of semiconductors, the physics and principles of operation
of various semiconductor devices including Schottky diodes, PN junction
diodes, photodetectors, LEDs, and bipolar junction transistors. Electrical,
Optical, and Physical characterization methods used for semiconductor
materials and devices.
Prereq.: Completion of at least one of the following courses or their equivalent:
PHYS 3742, PHYS 3750, PHYS 5810, or PHYS 5830.

PHYS 6971  Condensed Matter 1  3 s.h.
A study of the structure/property relationships of matter in the condensed
state at the electronic, atomic, and molecular level. Using quantum chemistry,
symmetry, chemical bonding, and electrochemistry, this course will investigate
the theoretical underpinnings for the properties of amorphous, crystalline,
and semi-crystalline structures including metals, semiconductors, ceramics,
polymers, and composites. Properties studied include mechanical, electrical,
thermal, and magnetic.
Prereq.: PHYS 3704 and PHYS 5810.

PHYS 6977  Physical Measures and Fundamental Characteristics  3 s.h.
A lecture course on the application of fundamental physical principles and
statistical techniques to the design, operation, characterization, optimization
and data analysis of data from a broad palette of transducers, sensors
and measurement systems. Signal noise detection modalities for noisy
environments, intrinsic sensor noise, technical noise.

PHYS 6980  Computer Environment Application Analysis  3 s.h.
A combined lecture (2hours/week) and laboratory (3 hours/week) course
that includes theoretical study and hands-on experience in a mixed signal
environment emphasizing data acquisition, software design and data analysis
using C and vector language tools (MATLAB). Interfacing, hard and soft
interrupts, micro-controller and embedded controller applications, FPGA, and
mixed signal ASICs and PLCs and ladder logic.
Prereq.: CSCI 3750 or equivalent.

PHYS 6981  Experimental Diagnostic Technology  3 s.h.
A combined lecture (2hours/week) and laboratory (3 hours/week) course
that includes theoretical study and hands-on experience in both hardware
and software used in creating, recording and analyzing telemetry from a
diverse cohort of sensors. Theoretical principles applied in the design/
implementation/analysis of sensing tools for developing diagnostic acumen.
Various data acquisition, reduction and control methodologies.
Prereq.: CSCI 3750 or equivalent, PHYS 3704, PHYS 3705.

PHYS 6989  Engineering Physics Internship  1-6 s.h.
One semester immersion, usually through full-time paid employment at a
partner company. Work completed at the internship site will contribute to the
professional development and expertise portfolio of the student.