**PHYSICS (3650)**

3650:130 Descriptive Astronomy (4 Credits)
Qualitative introduction to astronomy, intended primarily as a first science course for non-science majors. Includes laboratory and observational activities.
**Ohio Transfer 36:** Yes
**Gen Ed:** - Natural Science w/LAB

3650:133 Music, Sound & Physics (4 Credits)
Qualitative introduction to the physics of sound, its properties, perception and reproduction, including acoustical principles of musical instruments. Laboratory and observational activities included.
**Ohio Transfer 36:** Yes
**Gen Ed:** - Natural Science w/LAB

3650:137 Light (4 Credits)
Introductory, qualitative course dealing with the nature of light and the interaction of light with various materials to produce common visual effects. Laboratory activities provide experience in scientific investigation.
**Ohio Transfer 36:** Yes
**Gen Ed:** - Natural Science w/LAB

3650:150 Manufacturing Physics (4 Credits)
Prerequisite: Admission to the Manufacturing Engineering Technology program. Corequisite: 2030:154. Applications of physics to manufacturing including two dimensional motion, vectors, forces, statics, torque and simple electronic circuits. Laboratory.

3650:160 Technical Physics: Mechanics (4 Credits)
Corequisite: 2030:154. Applications of mechanics which include one and two dimensional motion, vectors, forces, equilibrium, work, power, conservation of energy, rotational motion & torque. Laboratory.
**Ohio Transfer 36:** Yes
**Gen Ed:** - Natural Science w/LAB

3650:161 Technical Physics: Mechanics I (2 Credits)
Corequisite: 2030:153. Principles of mechanics that include motion, vectors, forces, equilibrium; also significant figures and unit conversions. Laboratory.
**Gen Ed:** - Natural Science w/LAB

3650:162 Technical Physics: Mechanics II (2 Credits)
Prerequisites: 2030:153 and 3650:161. Principles of mechanics that include work, power, conservation of energy, rotational motion, torque. Laboratory.
**Gen Ed:** - Natural Science w/LAB

3650:163 Technical Physics: Electricity & Magnetism (2 Credits)
Prerequisites: 2030:154 and 3650:160 with a grade of C- or better in both. Principles and applications of electricity and magnetism. Electrostatics, DC circuits, magnetism, electromagnetism, and AC circuits. Laboratory.
**Ohio Transfer 36:** Yes
**Gen Ed:** - Natural Science w/LAB

3650:164 Technical Physics: Heat & Light (2 Credits)
Prerequisites: [3650:160 with a grade of C- or better] and 2030:154. Principles and applications of heat and light: heat energy, thermodynamics, electromagnetic waves, geometric and physical optics, introduction to quantum mechanics, and radiation.
**Ohio Transfer 36:** Yes
**Gen Ed:** - Natural Science

3650:261 Physics for Life Sciences I (4 Credits)
Prerequisites: high school algebra, trigonometry or placement test or appropriate AP score or 2030:154 or 3450:149 as corequisite. Introductory course for professional work in biology and health professions and services. Emphasizes life science applications. Mechanics: laws of motion, force, torque, work, energy, power; properties of matter: gases, liquids, solids, fluid mechanics. Includes laboratory activities.
**Gen Ed:** - Natural Science w/LAB

3650:262 Physics for Life Sciences II (4 Credits)
Prerequisite: 3650:160 or 3650:261. Laws of thermodynamics, kinetic theory. Wave phenomena: sound, light, optics; electricity and magnetism; atomic and nuclear physics; radioactivity. Includes laboratory activities.
**Gen Ed:** - Natural Science w/LAB

3650:267 Life Science Physics Computations I (1 Credit)

3650:268 Life Science Physics Computations II (1 Credit)

3650:291 Elementary Classical Physics I (4 Credits)
Prerequisite: Completion of 3450:221 with a grade of "C-" or better, or AP Calculus AB, or BC test score of 3 or better. Introductory physics for students of science and engineering. Classical kinematics and dynamics as related to contemporary physics. Oscillations, thermodynamics. Vectors and some calculus introduced as needed. Includes laboratory activities.
**Gen Ed:** - Natural Science w/LAB

3650:292 Elementary Classical Physics II (4 Credits)
Prerequisite: 3650:291. Fluid mechanics, mechanical and electromagnetic waves and wave phenomena, basic laws of electromagnetism, interference and diffraction, coherence, geometrical and physical optics. Includes laboratory activities.
**Gen Ed:** - Natural Science w/LAB

3650:293 Physics Computations I (1 Credit)
Corequisite: 3650:291. Optional companion courses to 3650:291 and 3650:292 provides experience in problem solving, and elaborates application of calculus to simple physical phenomena. Particularly recommended for a freshman and for student with modest preparation in mathematics or physical sciences.

3650:294 Physics Computations II (1 Credit)
Corequisite: 3650:292. Optional companion courses to 3650:291 and 3650:292 provides experience in problem solving, and elaborates application of calculus to simple physical phenomena. Particularly recommended for a freshman and for student with modest preparation in mathematics or physical sciences.

3650:301 Elementary Modern Physics (3 Credits)
Prerequisite: 3650:292. Special relativity, introduction to quantum physics, hydrogen atom and complex atoms, atomic spectra, topics in nuclear and solid-state physics.
3650:322 Intermediate Laboratory I (3 Credits)
Prerequisite: 3650:262 or 3650:292. Laboratory course stressing measurement techniques with contemporary laboratory apparatus. Experiment design, instrument calibration and reporting emphasized. Modern physics experiments and measurement of fundamental natural constants.

3650:323 Intermediate Laboratory II (3 Credits)
Prerequisite: 3650:262 or 3650:292. Laboratory course stressing measurement techniques with contemporary laboratory apparatus. Experiment design, instrument calibration and reporting emphasized. Modern physics experiments and measurement of fundamental natural constants.

3650:340 Thermal Physics (3 Credits)
Prerequisite: 3650:262 or 3650:292. Basic principles of thermal and statistical physics. Ensembles, laws of thermodynamics, equilibrium, irreversibility, equipartition theorem, canonical distribution, Maxwell distribution, phase changes, cyclic processes, transport processes.

3650:350 Modeling & Simulation (4 Credits)
Prerequisites: [3650:262 or 3650:292] and [3460:208 or 3460:209]. Interdisciplinary course stressing modeling of natural phenomena using fundamental principles and their simulation. Topics may include growth phenomena, fault propagation, kinetics, chemical reactions, wave phenomena.

3650:399 Undergraduate Research (1-6 Credits)
(May be repeated) Prerequisite: Permission of instructor. Participation in current research project in department under supervision of faculty member.

3650:401 Everyday Physics (4 Credits)
Prerequisite: Permission of instructor. College-level physics content for future teachers. Inquiry, discovery, activities, discussion, and experiential learning take place in a laboratory/embedded-lecture environment.

3650:406 Optics (3 Credits)

3650:431 Mechanics I (3 Credits)

3650:432 Mechanics II (3 Credits)
Prerequisite: 3650:431. Advanced mechanics at the senior or beginning graduate level, moving coordinate systems, mechanics of continuous media, Lagrange's equations, tensor algebra and stress analysis, rotation of rigid bodies, vibration theory.

3650:436 Electromagnetism I (3 Credits)
Prerequisites: 3650:291, and 3650:350, and 3450:335. Electricity and magnetism at intermediate level. Electrostatics and magnetostatics, electric field, scalar potential, dielectrics, Laplace's and Poisson's equations, currents, magnetic field, vector potential, magnetic materials, inductance.

3650:437 Electromagnetism II (3 Credits)
Prerequisite: 3650:436. Special relativity, four vectors, Maxwell's equations in covariant form; propagation, reflection and refraction of electromagnetic waves; multipole radiation.

3650:441 Quantum Physics I (3 Credits)
Prerequisites: 3650:301, and 3650:350, and 3450:335. Introduction to quantum theory, Schrödinger equation, observables, angular momentum, perturbation theory, variational principle, bound states, scattering theory, radiative interactions, spin and the Pauli Principle.

3650:442 Quantum Physics II (3 Credits)
Prerequisite: 3650:441. Applications of quantum mechanics to atomic, nuclear and solid state physics. Tunneling and alpha decay, periodic potential, hydrogen and helium atoms, interatomic forces, quantum statistics.

3650:451 Advanced Laboratory I (3 Credits)
Prerequisite: 3650:323. Experimental techniques, applicable to research-type projects in contemporary physics. FTIR spectroscopy, optical spectroscopy, lasers and thin-film growth and characterization.

3650:452 Advanced Laboratory II (3 Credits)
Prerequisite: 323 or permission of instructor. Experimental projects applicable to contemporary physics. Diode and dye lasers, NMR, SPM, chaos, electron tunneling and fiber optics.

3650:470 Introduction to Solid-State Physics (3 Credits)
Prerequisite: 3650:441. Account of basic physical processes occurring in solids, with emphasis on fundamental relation between these processes and periodicity of crystalline lattice.

3650:481 Methods of Mathematical Physics I (3 Credits)
Prerequisites: 3650:292, 3650:350, 3450:335 and senior or graduate standing in a physical science or engineering. Vectors, generalized coordinates, tensors, calculus of variations, vector spaces, linear transformations, matrices, eigenvalues, Hilbert space, boundary value problems, transcendental functions, complex variables, analytic functions, Green's functions, integral equations.

3650:482 Methods of Mathematical Physics II (3 Credits)
Prerequisites: 3650:292, 3450:335 and senior or graduate standing in a physical science or engineering. Vectors, generalized coordinates, tensors, calculus of variations, vector spaces, linear transformations, matrices, eigenvalues, Hilbert space, boundary value problems, transcendental functions, complex variables, analytic functions, Green's functions, integral equations.

3650:488 Selected Topics: Physics (1-4 Credits)
(May be repeated) Prerequisite: Permission. Consideration of selected topics, procedures, techniques, materials or apparatus of current interest in physics.

3650:490 Workshop: Physics (1-4 Credits)
(May be repeated) Group studies of special topics in physics. May not be used to meet undergraduate or graduate major requirements in physics. May be used for elective credit only.

3650:497 Independent Study: Physics (1-4 Credits)
(May be repeated) Prerequisite: Permission. Further investigations of various selected topics in physics, under guidance of faculty member.

3650:498 Physics Colloquium (1 Credit)
Lectures on current research topics in physics by invited speakers. May be repeated but only one credit counts toward the M.S. Degree. Offered on a credit/noncredit basis only.