Courses for the Physics Minor

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Required Courses (13 credit hours)

PHYS 1408 - Principles of Physics I. 4 Credit Hours. Prerequisite: MATH 1451. Calculus-based introductory physics covering mechanics, kinematics, energy, momentum, and thermodynamics. (Honors section offered) Partially fulfills core Life and Physical Sciences requirement. [all]

PHYS 2401 - Principles of Physics II. 4 Credit Hours. Prerequisites: PHYS 1408 and MATH 1452. Calculus-based introductory physics covering electric and magnetic fields, electromagnetic waves, and optics. (Honors section offered) Partially fulfills core Life and Physical Sciences requirement. [all]

PHYS 3301 - Principles of Physics IV: Introduction to Quantum Physics. 3 Credit Hours. Prerequisites: PHYS 1408 and MATH 2450. Corequisite: PHYS 3201. Failure of classical physics in the microscopic realm, development and fundamentals of quantum theory, applications to atoms, molecules, solids, nuclei, and particles. [Fall & Spring]

PHYS 3201 - Modern Physics Lab and Data Analysis. 2 Credit Hours. Corequisite: PHYS 3301. Laboratory experiments and accompanying lectures designed to illustrate the basis of quantum physics and proper techniques for data acquisition, analysis, and determination of uncertainties. [Fall & Spring]

Electives (choose 6 credit hours)

PHYS 3000 - Undergraduate Research. 1-6 Credit Hours. Prerequisite: Permission of the instructor. Individual and/or group research projects in basic or applied physics, under the guidance of a faculty member. [all]

PHYS 3304 - Intermediate Physics Laboratory. 3 Credit Hours. Prerequisite: C or better in PHYS 3301 and PHYS 2305. Laboratory course on advanced physical principles. Experiments in atomic, molecular, solid state, and nuclear, and particle physics as well as relativity, electricity and magnetism including data acquisition and analyses. (CL) [Spring]

PHYS 3305 - Electricity and Magnetism. 3 Credit Hours. Prerequisite: PHYS 2401 and PHYS 4325 or MATH 3350 or MATH 3354. Electrostatics, dielectric materials, Maxwell's equations, currents, and magnetostatics. [Fall]

PHYS 3306 - Electricity and Magnetism. 3 Credit Hours. Prerequisite: PHYS 3305 and PHYS 4325 or MATH 3351 or MATH 4354. Magnetic properties of materials, electrodynamics, electromagnetic waves, waveguides and resonators, interaction with matter, AC circuits, radiation. [Spring]

PHYS 3401 – Optics. 4 Credit Hours. Prerequisites: PHYS 3301. Covers geometrical and physical optics, waves, reflection, scattering, polarization, interference, diffraction, modern optics, and optical instrumentation. (CL) [Fall]

PHYS 4000 - Independent Study. 1-4 Credit Hours. Prerequisite: Approval of advisor and instructor. Study of advanced topics of current interest under direct supervision of a faculty member. [all]

PHYS 4301 - Computational Physics. 3 Credit Hours. Prerequisites: PHYS 1408, PHYS 2305, PHYS 2401, PHYS 3301. Numerical modeling of physical systems. Data acquisition and analysis. Graphics for displaying complex results. Quadrature schemes, solution of equations. [Spring]

PHYS 4302 - Statistical and Thermal Physics. 3 Credit Hours. Prerequisites: PHYS 3301 and PHYS 4325 or MATH 3350 or MATH 3354. Introduction to statistical methods in physics. Formulation of thermodynamics and statistical mechanics from a unified viewpoint with applications from classical and quantum physics. [Spring]

PHYS 4304 – Mechanics. 3 Credit Hours. Prerequisites: PHYS 1408 and PHYS 4325 or MATH 3350 or MATH 3354 or department chair consent. Dynamics of particles and extended bodies, both rigid and fluid, using Newtonian mechanics and the Euler-Lagrange equations from Hamilton's principle. Nonlinear systems and chaos with numerical modeling. Applications of the Navier Stokes equation. [Spring]

PHYS 4307 - Quantum Mechanics I. 3 Credit Hours. Prerequisite: C or better in PHYS 3301 and PHYS 4325 or MATH 3351 or MATH 4354. Introduction to fundamental concepts in quantum mechanics: probability, normalization, operators, solutions to Schrodinger equation for various potentials. Discussion of quantum mechanics in 3D, generalized uncertainty principle, angular momentum and hydrogen atom. [Fall]

PHYS 4308 - Quantum Mechanics II. Prerequisite: PHYS 4307. Review of quantum mechanics, time-independent and dependent perturbation theory, variational principle, WKB approximation, the adiabatic approximation and scattering. [Spring]

PHYS 4309 - Solid State Physics. 3 Credit Hours. Prerequisites: PHYS 3305 and knowledge of elementary quantum mechanics. The structural, thermal, electric, and magnetic properties of crystalline solids. Free electron theory of metals. Concept of energy bands and elementary semiconductor physics. [Odd Falls]

PHYS 4312 - Nuclear and Particle Physics. 3 Credit Hours. Prerequisite: PHYS 4307. Deals with modern nuclear physics covering such topics as nuclear structure models, radioactivity, nuclear reactions, elementary particles, nuclear conservation, forces, and symmetry. [Spring]

PHYS 4315 – Introduction to Quantum Computing. 3 Credit Hours. Prerequisite: Permission of instructor. Covers two-level quantum systems, qubits, quantum gates and circuits, measurement, entanglement, Bell's Theorem, no-cloning theorem, quantum parallelism, quantum teleportation, quantum algorithms. [Fall]

PHYS 4325 - Mathematical Methods in Physical Sciences I. Prerequisite: C or better in MATH 2450. Vectors and coordinate systems, vector and scalar fields, ordinary differential equations, boundary-value problems and partial differential equations. [Spring]

PHYS 4326 - Mathematical Methods in Physical Sciences II. Prerequisite: C or better in PHYS 4325. Calculus of variations, an introduction to complex analysis special functions, integral transforms. [Fall]

PHYS 4350 – Relativity. 3 Credit Hours. Prerequisites: C or better in PHYS 3305 and PHYS 4304 (the latter may be taken concurrently). Introduction to spacetime, differential geometry, special and general relativity; with applications to black holes, cosmology, and gravitational waves. [Spring]

ASTR 3300. Special Topics in Astrophysics. 3 Credit Hours. C- or better in ASTR 2401, PHYS 2302, PHYS 3301, and PHYS 4325 or MATH 3350 or MATH 3354. *(Some prerequisites may be waived by instructor on a case by case basis.)* Topics in radio astronomy, X-ray astronomy, gravitational wave astronomy, compact objects, accretion, stellar explosions and others. May be repeated in different areas. [Spring]

ASTR 4301 - Astrophysics I. 3 Credit Hours. Prerequisite: PHYS 3301. Introduction to the tools of astronomy, stellar properties, stellar structure, and stellar evolution. [Spring]

ASTR 4302 - Astrophysics II. 3 Credit Hours. Prerequisite: PHYS 3301. Structure, formation and evolution of galaxies; cosmology. [Fall]

ASTR 4305 - Radiative Processes in Astrophysics. 3 Credit Hours. Prerequisites: C or better in PHYS 3305 and PHYS 4307 (the latter may be taken concurrently). A survey of the physical processes related to the production and propagation of radiation in astrophysical phenomena, including thermal and non-thermal radiation, and atomic transitions. [Fall]

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