Modified Physics Course Descriptions

Old

PHYS 122, General Physics II, 4 cr, 3 cl hrs, 2 recitation hrs

Prerequisite: PHYS 121
Corequisites: MATH 132; PHYS 122L
Continuation of PHYS 121 including ~~electricity and magnetism, optics, and atomic and nuclear phenomena.~~ [NMCCNS PHYS 1225: General Education Area III]

PHYS 241, Computational Physics, 3 cr, 3 cl hrs

~~*Prerequisite: PHYS 121 or Corequisite PHYS 221; MATH 132*~~
~~This course goes into more depth than first year college physics courses on key classical concepts such as force, acceleration, Newton's Laws, and conservation laws. New mathematics will include numerical solution of differential equations and statistical techniques for experimental scientists. The fundamental physics is reinforced by numerical simulations and calculations that the students write themselves. Along the way, students are taught to program in a scientific computing environment. Students should emerge with a firm grasp of classical mechanics and computational skills.~~

~~PHYS 242, Vibrations and Waves, 4 cr, 3 cl hrs, 3 lab hrs~~

~~*Prerequisite: PHYS 122 or 221; MATH 231*~~
~~Vibrations and waves are examined from both theoretical and experimental standpoints. Theory describing simple vibrating systems, including coupled oscillators. Laboratory measurements on electrical analogs of vibrating systems. Wave theory for transverse and longitudinal waves. Experiments using electromagnetic radiation in the visible, microwave, and X-ray regions are used to illustrate the nature of waves.~~

PHYS 321, Intermediate Mechanics, 3 cr, 3 cl hrs

Prerequisites: PHYS ~~241~~
Corequisite: MATH 335
An intermediate course in the dynamics and statics of particles and rigid bodies. Introduction to Lagrangian and Hamiltonian mechanics.

New

PHYS 122, General Physics II, 4 cr, 3 cl hrs, 2 recitation hrs

Prerequisite: PHYS 121
Corequisites: MATH 132; PHYS 122L
Continuation of PHYS 121 including electricity, magnetism and optics. [NMCCNS PHYS 1225: General Education Area III]

PHYS 241, Computational Physics I, 3 cr, 2 cl hrs, 2 hr recitation/computer lab

Co-requisites: MATH 254; PHYS 221 or consent of instructor
This course will provide an introduction to a programming language and to basic algorithms that can be used to solve introductory physics problems (e.g. statics, relative motion, projectile motion) with a computer. Most of the problems will be deterministic in nature and will have analytical solutions that the students will be able to use to verify their numerical solutions. The course will also cover topics related to data analysis and visualization.

PHYS 242, Computational Physics II, 3 cr, 2 cl hrs, 2 hr recitation/computer lab

Prerequisite: PHYS 241; Co-requisites: PHYS 222; or consent of instructor
This course will go more in depth into numerical methods to solve problems involving the numerical solution of differential equations (oscillations, orbital motion, waves and vibrations.) Different algorithms will be compared to determine their level of accuracy and applicability. The course will explore other aspect of physics that can't be solved using deterministic algorithms (e.g. random walks).

PHYS 321, Intermediate Mechanics, 3 cr, 3 cl hrs

Prerequisites: PHYS 242, MATH 254
Corequisite: MATH 335
An intermediate course in the dynamics and statics of particles and rigid bodies. Introduction to Lagrangian and Hamiltonian mechanics.

PHYS 327L, 328L, Astronomy Laboratory, 1 cr, 3 lab hrs ~~each semester~~

~~Prerequisites: PHYS 122, 122L or PHYS 222, 222L; or consent of instructor~~

A ~~self-paced~~ introduction to astronomical observing and data reduction. Emphasis on ~~techniques such as the operation of~~ telescopes and their auxiliary equipment, ~~astronomical photography~~, photometry, spectroscopy, and data handling. Exercises chosen from topics in solar system, stellar, galactic, and extragalactic astronomy.

PHYS 327L, 328L, Astronomy Laboratory, 1 cr each, 3 lab hrs per week

PHYS 327L: Corequisite: PHYS 325; or consent of instructor

PHYS 328L: Prerequisite: PHYS 327L or consent of instructor

An introduction to astronomical observing and data reduction. Emphasis on the techniques of operating telescopes and their auxiliary equipment, including CCD imaging, photometry, spectroscopy, and data handling. Exercises are chosen from topics in solar system, stellar, galactic, and extragalactic astronomy. This class includes a nighttime observing component.

PHYS 333, Electricity and Magnetism, 3 cr, 3 cl hrs

Prerequisites: PHYS 122 or PHYS 222; PHYS 242; MATH 332

Corequisite: MATH 335

~~This subject is one of the cornerstones for understanding a huge variety of phenomena — electronic and optical devices, communication by telephone, radio waves, optical fibers, and the behavior of atoms and molecules. It is remarkable that so much insight comes from Maxwell's four equations and the Lorentz force law. This course develops these equations in detail and applies them to a variety of problems. It also helps students develop an understanding of the applications of more advanced mathematics in a physical context.~~

PHYS 333, Electricity and Magnetism, 3 cr, 3 cl hrs

Prerequisites: PHYS 122 or PHYS 222; PHYS 242; MATH 332

Corequisite: MATH 335

Maxwell's four short equations use the language of vector calculus to describe problems involving charge, current, voltage, electric fields, and magnetic fields. These equations will be developed and unpacked, with applications to static and varying electric fields and magnetic fields, electric circuits, and dielectric materials. Maxwell's equations in conductors and conductivity of metals, semiconductors and gasses will be considered.

PHYS 334, Radiation and Optics, 3 cr, 3 cl hrs

Prerequisites: PHYS 333; MATH 335

This course explores the behavior of electromagnetic waves, including optical waves, using Maxwell's equations and the Lorentz force law. Included in the course are the topics of radiation, conservation laws, relativistic and non relativistic electrodynamics, basic geometrical optics and aberration theory, and specific phenomena such as polarization, diffraction and interference. The class will include ~~demonstrations and~~ discussions of ~~these phenomena and~~ modern optical devices.

PHYS 334, Radiation and Optics, 3 cr, 3 cl hrs

Prerequisites: PHYS 333; MATH 335

This course explores the behavior of electromagnetic waves, including optical waves, using Maxwell's equations and the Lorentz force law. Included in the course are the topics of radiation, conservation laws, relativistic and non relativistic electrodynamics, basic geometrical optics and aberration theory, and specific phenomena such as polarization, diffraction and interference. The class will include discussions of modern optical devices.

~~PHYS 336L, Electrical and Magnetic Measurements Lab, 1 cr, 3 lab hrs~~

Prerequisite: PHYS 333

~~Experiments in electricity and magnetism, emphasizing applications to measurements in physics and geophysics.~~

PHYS 336L, Electrical and Magnetic Measurements Lab, 1 cr, 3 lab hrs

Prerequisite: PHYS 333

A set of experiments reinforce the concepts of electromagnetism learned in Physics 333 and give students added facility with common laboratory instrumentation. The behavior of resistors, capacitors and inductors is studied with oscilloscopes and function generators and understood with the formalism of complex impedance. Transformers, transistors and operational amplifier circuits are studied. Data acquisition and digital control techniques are introduced using the Arduino embedded platform.

PHYS 340, Introduction to Quantum Theory, 3 cr, 3 cl hrs

Prerequisites: PHYS 321; MATH 254, 335, or consent of instructor

~~Electrons, atoms, and radiation. Wave particle experiments, introductory quantum mechanics, atomic structure and spectra, the hydrogen atom, exclusion principle, electronic structure of atoms, and diatomic molecules.~~

PHYS 340, Introduction to Quantum Theory, 3 cr, 3 cl hrs

Prerequisites: PHYS 321; MATH 254, 335, or consent of instructor

Fundamental ideas of quantum physics including the postulates of quantum theory, wave functions, stationary and non-stationary states, operators, measurements, the Schrodinger equation, one-dimensional and three dimensional systems including the hydrogen atom.

~~PHYS 421, Continuum Mechanics, 3 cr, 3 cl hrs~~

~~*Prerequisites: PHYS 121 or PHYS 221; MATH 332, 335*~~

~~*Offered on demand*~~

~~Statics and dynamics of fluids and elastic bodies.~~

Class deleted. Only PHYS 521 now exists.

PHYS 425, Astrophysics III: Plasma Astrophysics, 3 cr, 3 cl hrs

Prerequisites: PHYS 325, 326, ~~333~~

Plasma and fluid physics govern most of the luminous matter in the universe. This course surveys the many aspects of plasma physics, from microphysics (single particle motions, waves and oscillations, collisions) to macrophysics (the fluid description and magnetohydrodynamic effects). Applications will include a wide variety of astrophysical objects, from the earth's magnetosphere and the solar wind, to accretion disks and radio jets.

PHYS 425, Astrophysics III: Plasma Astrophysics, 3 cr, 3 cl hrs

Prerequisites: PHYS 325, 326, 334

Plasma and fluid physics govern most of the luminous matter in the universe. This course surveys the many aspects of plasma physics, from microphysics (single particle motions, waves and oscillations, collisions) to macrophysics (the fluid description and magnetohydrodynamic effects). Applications will include a wide variety of astrophysical objects, from the earth magnetosphere and the solar wind, to accretion disks and radio jets.

PHYS 426, Astrophysics IV: High Energy Astrophysics, 3 cr, 3 cl hrs

Prerequisites: PHYS ~~333~~ and 425; or consent of instructor

This course continues the application of fluid and plasma physics to astrophysics. Radiation processes and diagnostics, shock physics, high energy plasmas, and cosmic ray acceleration. Many applications will come from our galaxy, including the interstellar medium, star formation, supernovae, black holes, and pulsars. We will go beyond the boundaries of our galaxy to study active galactic nuclei and their connection to galaxy formation.

PHYS 426, Astrophysics IV: High Energy Astrophysics, 3 cr, 3 cl hrs

Prerequisites: PHYS 334 and 425; or consent of instructor

This course continues the application of fluid and plasma physics to astrophysics. Radiation processes and diagnostics, shock physics, high energy plasmas, and cosmic ray acceleration. Many applications will come from our galaxy, including the interstellar medium, star formation, supernovae, black holes, and pulsars. We will go beyond the boundaries of our galaxy to study active galactic nuclei and their connection to galaxy formation.

PHYS 432, Atmospheric Remote Sensing, 3 cr, 3 cl hrs

Prerequisites: PHYS 122 or 222

~~Remote sensing from space and ground based instruments is a useful technique for monitoring the physical and chemical state of the atmosphere.~~ This course will examine the physics of remote sensing using radio, microwave, infrared, visible, and ultraviolet instruments. Topics will include both active and passive systems for measuring atmospheric temperature, composition, and dynamics.

PHYS 432, Atmospheric Remote Sensing, 3 cr, 3 cl hrs

Prerequisites: PHYS 122 or 222

This course will examine the physics of atmospheric remote sensing using radio, microwave, infrared, visible, and ultraviolet instruments. Topics will include both active and passive systems for measuring atmospheric temperature, composition (such as water vapor and ozone), and dynamics.

PHYS 433, Special Problems in Atmospheric Physics, 3 cr, 3 cl hrs

~~Prerequisite: PHYS 331~~

Offered spring semesters

Project in which student works with a member of the atmospheric physics group on current research. This project is expected to lead to a report, conference presentation, or contribution to a published paper. The student should contact an appropriate faculty member within the first two weeks of the fall semester to organize a project.

PHYS 433, Special Problems in Atmospheric Physics, 3 cr, 3 cl hrs

Prerequisite: Consent of Instructor

Offered spring semesters

Project in which student works with a member of the atmospheric physics group on current research. This project is expected to lead to a report, conference presentation, or contribution to a published paper. The student should contact an appropriate faculty member within the first two weeks of the fall semester to organize a project.

PHYS 443, Atomic and Nuclear Physics, 3 cr, 3 cl hrs

Prerequisite: PHYS 340

Continuation of PHYS 340. Further topics in atomic and molecular structure~~. Quantum statistics with applications to degenerate Fermi and Bose fluids.~~ Radioactivity, elements of nuclear structure, nuclear energy sources. ~~Mesons, hyperons, and resonances.~~

PHYS 443, Atomic and Nuclear Physics, 3 cr, 3 cl hrs

Prerequisite: PHYS 340

Continuation of PHYS 340. Further topics in atomic and molecular structure, including fine/hyperfine structure, atomic/molecular spectroscopy, many electron systems and quantum statistics. Further topics in nuclear physics including radioactivity, elements of nuclear structure, and nuclear energy sources.

PHYS 444, Solid State Physics, 3 cr, 3 cl hrs

Prerequisite: PHYS 340 or consent of instructor
Offered on demand

~~Theory and application of solid state devices;~~ binding in molecules and crystals; energy bands; electrons in metals; imperfections in solids; electrical, thermal, and magnetic properties of solids; and semiconductor theory.

PHYS 449, Astrobiology, 3 cr, 3 cl hrs

Prerequisite: CHEM ~~121 C~~ 122, PHYS ~~121 C~~ 122, one other science course, **and** *consent of instructor.*

An in depth and interdisciplinary study of astrobiology, including interactions between living and non living systems at multiple scales: stellar, planetary, meso-, and microscopic. Addresses fundamental questions regarding the origin of life, and the possible extent and distribution of life in the universe. Combines principles of astrophysics, geosciences, planetary science, chemistry, and biology. Innovative interactive exercises and projects working in interdisciplinary groups and individually. Shares lecture with PHYS 549, with additional expectations for graduate credit. (Same as BIOL 449 and ERTH 449)

PHYS 444, Solid State Physics, 3 cr, 3 cl hrs

Prerequisite: PHYS 340 or consent of instructor
Offered on demand

Crystalline structure and reciprocal lattices; binding in molecules and crystals; energy bands; electrons in metals; imperfections in solids; electrical, thermal, and magnetic properties of solids; semiconductor theory and superconductivity.

PHYS 449, Astrobiology, 3 cr, 3 cl hrs

Prerequisite: CHEM 122, PHYS 122, one junior/senior level major class, **and** *consent of instructor.*

An in depth and interdisciplinary study of astrobiology, including interactions between living and non living systems at multiple scales: stellar, planetary, meso-, and microscopic. Addresses fundamental questions regarding the origin of life, and the possible extent and distribution of life in the universe. Combines principles of astrophysics, geosciences, planetary science, chemistry, and biology. Innovative interactive exercises and projects working in interdisciplinary groups and individually. Shares lecture with PHYS 549, with additional expectations for graduate credit. (Same as BIOL 449 and ERTH 449)