

PHYS 3006 Renewable Energy Sources (3,3,0) (E)

Prerequisite: PHYS 2005 Heat and Motion or consent of instructor

This course covers the physics and working principles of renewable energy sources such as wind, water, biomass, and geothermal energy. Environmental impacts of the various technologies are explained. Selected examples of emerging technologies and latest developments are also discussed.

PHYS 3007 Energy Storage, Distribution and Conservation (3,3,0) (E)

Prerequisite: PHYS 2005 Heat and Motion or consent of instructor

This course explores the current practice and emerging technologies in energy storage, distribution and efficient energy usage. Selected topics on novel technologies such as high power density rechargeable batteries, nonhydrogen based fuel cells, and smart energy management etc. will also be discussed.

PHYS 3015 Structure and Properties of Matter (3,3,0) (E)

Prerequisite: PHYS 3005 Atomic and Nuclear Physics or consent of instructor

By using the framework of quantum physics, this course examines the structural, chemical, and electronic properties of matter, which form the basis for energy device applications.

PHYS 3016 Energy Management (3,3,0) (E)

Prerequisite: PHYS 2005 Heat and Motion or consent of instructor

This course explores the basic energy management strategy to streamline energy flow and maximize energy usage efficiency in daily life. In addition to new supply-side management topics not covered in PHYS 3007 Energy Storage, Distribution and Conservation, the course will emphasize demand-side management including economics models, energy audit procedure, user-based source planning and implementation methods.

PHYS 3017 Green Energy Lab with LabVIEW (3,0,3)

This course provides an introductory level to graphical programming for data acquisition and instrument control encountered by science students, using LabVIEW™ as the programming platform. This course has experiments in the area of energy generation and device characterization such that the measurements are carried out with the use of LabView for data acquisition, data conversion, information presentation and file storage and retrieval.

PHYS 3025 Physics and Technology of Energy Conversion (3,3,0)

Prerequisite: PHYS 2005 Heat and Motion or consent of instructor

This course provides a solid foundation of energy conversion technology which is the key to renewable energy science. The processes include the conversion of Thermal, Mechanical and Chemical energy into electricity.

PHYS 3026 Instrumentation and Data Acquisition Laboratory (3,*,*)

Prerequisite: COMP 1005 Essence of Computing

This course introduces graphical programming for data acquisition and instrument control encountered by science students, using LabVIEW™ as the programming platform. This course provides a basic concept of hardware interface and sampling theory, and to equip students with practical skills to data acquisition, analysis and instrument control.

PHYS 3027 Intermediate Electromagnetism (3,3,0) (E)

Prerequisite: PHYS 2006 Electricity and Magnetism or consent of instructor

This course studies electromagnetism up to Maxwell's equations at an intermediate level. It uses the tools of vector calculus for

solving special problems in electrostatics and magnetostatics including the presence of dielectric and magnetic materials.

PHYS 3035 Energy and Thermodynamics (3,3,0) (E)

Prerequisite: PHYS 2005 Heat and Motion or consent of instructor

This course introduces the relation between free energy and kinematics by demonstrating the statistical formalism of thermodynamics. Different kinds of free energy for different ensembles will be discussed, followed by applications of the statistical formalism to simple thermodynamic systems.

PHYS 3036 Mechanics (3,3,0)

Prerequisite: PHYS 2005 Heat and Motion or consent of instructor

This course deals with the basic theory of Lagrangian and Hamiltonian mechanics, coupled oscillations, and central force motion. It extends the basic discussions on mechanical motion in the lower level course, Heat and Motion, to a more general mathematical and theoretical framework, and provides a broader foundation for understanding and employing classical mechanics in energy science applications.

PHYS 3120 Statistical Physics I (4,4,0) (E)

Co-requisite: Year III standing or consent of the instructor

Foundation course on thermal and statistical physics. After a discussion of thermodynamic systems and processes, the basic postulates and framework of the statistical mechanics will be laid out, and connections to the classical thermodynamic laws will be made. The formalism will then be applied to simple classical and quantum systems such as the ideal gas, paramagnetic solid, free electron gas and phonons in solids, etc. The quantum statistics of Bosons and Fermions will be introduced.

PHYS 3140 Solid State Physics I (3,3,0) (E)

Prerequisite: PHYS 3120 Statistical Physics I or consent of the instructor

This course studies applications of statistical physics and quantum mechanics to the solid state of matter. Aspects included are crystal structures, X-ray diffraction, lattice dynamics, thermal properties, and band theory of solids.

PHYS 3150 Quantum Mechanics I (4,4,0) (E)

Prerequisite: PHYS 2260 Modern Physics

The course begins with a revision of the elementary wave mechanics for a particle in one dimension. The basic formalism of quantum mechanics is then introduced after equipping students with tools from linear algebra. The theory is then applied to the treatment of the hydrogen atom and classification of angular momentum eigenstates. The wave functions for many-electron systems and their applications will be introduced.

PHYS 3170 Solid State Physics II (3,3,0)

Prerequisite: PHYS 3140 Solid State Physics I or consent of the instructor

This course is a continuation of PHYS 3140 Solid State Physics I. A wide range of properties of solids, which include charge transport phenomena, optical properties, dielectric properties, and selected new materials of current interest will be treated in detail.

PHYS 3240 Experimental Physics IV (2,0,3) (E)

Prerequisite: Year III standing or consent of the instructor

This course consists of a series of laboratory experiments complementing the courses PHYS 2260 Modern Physics, PHYS 2130 Electromagnetism I, PHYS 3120 Statistical Physics I and PHYS 2140 Electromagnetism II.

PHYS 3250 Experimental Physics V (2,0,2)

Prerequisite: Year III standing or consent of the instructor

This course consists of a series of laboratory experiments complementing to year three courses, as well as some level two courses.