ENGINEERING PHYSICS (ENGP)

ENGP 1005 Intro Electronics with Lab (3 Credit Hours)
Introductory course designed for high school students enrolled in the TSSP summer program.

ENGP 1010 Intro to Maker Space (3 Credit Hours)
The course will focus on practical application and a “hands-on” lab approach to learning design software and creating working models using the tools of the MakerSpace. Limited to high school students.

ENGP 1015 Intro to Engineering Design (3 Credit Hours)
The objective of this course is to introduce high school students to the product design process. Through team projects geared toward creating physical solutions for real world problems, students will be challenged to begin thinking critically and applying physical fundamentals to complex systems. Daily lectures will highlight phases of the design process, including problem identification, conceptual design, and early prototyping. Additionally students will gain experience with computer-aided design and be provided an introduction to rapid prototyping. This will be a 2 week course, and will only be open to high school students.

ENGP 1410 Statics (3 Credit Hours)
Statics of particles and rigid bodies. Concepts of force, moments, free body diagrams, equilibrium and friction with engineering applications.
Prerequisites: PHYS 1310.

Prerequisite(s): PHYS 1310, 1310, 1310 or 1310.

ENGP 1940 Transfer Coursework (3 Credit Hours)

ENGP 2010 Electric Circuits (3 Credit Hours)
A fundamental course dealing with electric charge, current, voltage, power, energy, and passive and active circuit elements. Response of linear circuits to steady state and time dependent signals, differential equations, circuit laws, network analysis, frequency response, phasors, and transfer functions.
Prerequisites: MATH 1220, PHYS 1320.

Prerequisite(s): (PHYS 1320, 1320, 1320 or 1320) and (MATH 1220, 1220, 1220, 1220, 1310, 1310, 1310 or 1310).
Corequisite(s): ENGP 2011.

ENGP 2011 Electric Circuits Lab (1 Credit Hour)
This course is intended to provide an understanding of the basic principles of electronics, including the design and application of electronic projects to real-world objectives. The course will focus on practical application and a “hands-on” lab approach to electronics. Some computer programming will also be included.

Prerequisite(s): ENGP 2010*.

*May be taken concurrently.

ENGP 2020 Computing Concepts & App. (4 Credit Hours)
This course introduces students to the foundations of algorithm development and programming, the basics of matrix algebra, numerical analysis, and solving ordinary differential equations.

Corequisite(s): ENGP 2021.

ENGP 2021 Computing Concepts & App. Lab (0 Credit Hours)
Lab for ENGP 2020

ENGP 2310 Product & Experimental Design (3 Credit Hours)
The objective of this course is to introduce students to the design process as they are starting their engineering studies. Through team projects geared toward translating bench research into product development, students will be challenged to begin thinking critically and applying physical fundamentals to complex systems. Weekly lectures will highlight phases of the design process, including problem identification, conceptual design, and early prototyping. Additionally, in the context of product and experimental design, students will gain experience with computer aided design and be provided an introduction to statistics. Course restricted to ENGP and PHYS majors, or by permission of the instructors.

Corequisite(s): ENGP 2311.

ENGP 2311 Product & Experimental Dsgn Lab (0 Credit Hours)
Lab section for ENGP 2310

Corequisite(s): ENGP 2310.
ENGP 2420 Engineering Dynamics (3 Credit Hours)
Kinematics and kinetics of particles and rigid bodies. Work-energy and impulse-momentum methods applied to particles and rigid bodies. Mechanical vibrations. Prerequisites: MATH 1220 and ENGP 1410

Prerequisite(s): (MATH 1220, 1220, 1220, 1220, 1310, 1310 or 1210) and (ENGP 1410, 1410, 1410 or 1410).

ENGP 2430 Mechanics of Materials (3 Credit Hours)
Concepts of stress and strain. Generalized Hooke's Law. Mohr's circle. Formulations for axial, shear, bending, torsion, and combined stresses applied to tension members, pinned points, symmetric and unsymmetric beams, and shafts. Euler buckling criteria for columns. Prerequisites: ENGP 2410, MATH 1220.

Prerequisite(s): (ENGP 1410, 1410, 1410 or 1410) and (MATH 1220, 1220, 1220, 1220, 1310, 1310 or 1310).

ENGP 2890 Service Learning: ENGP 2430 (0-1 Credit Hours)
This course fulfills the lower division service learning requirement. See the advisor for Engineering Physics. PHYS 2910 may be substituted for this.

ENGP 2940 Transfer Course Work (3 Credit Hours)

ENGP 3120 Materials Science & Engr (3 Credit Hours)
The structure and properties of engineering materials are considered. Coverage includes basic atomic and microscopic structure, testing methods, phase relationships, and strengthening techniques. Emphasis is placed on common industrial materials. Thermodynamics and kinetics aspects of material science are discussed. Prerequisites: CHEM 1070, CHEM 1080, PHYS 1310, PHYS 1320, MATH 2210.

Prerequisite(s): (CHEM 1080, 1080, 1080 or 1080) and (PHYS 1320, 1320, 1320 or 1320) and (MATH 2210, 2210, 2210 or 2210).

ENGP 3170 Computnl Physics & Engr (3 Credit Hours)
An introduction to the use of computational methods in physics and engineering. Writing computer code and using data visualization techniques to solve experimental and theoretical problems. Data analysis and modeling, Monte Carlo simulations, numerical differentiation and integration, ordinary and partial differential equations, electrostatics, nonlinear dynamics and chaos, fast Fourier transform, noisy signal processing, quantum spectra, thermodynamics. Prerequisites: PHYS 2350 and MATH 2210 or 2240.

Prerequisite(s): PHYS 2350 and (MATH 2210, 2210, 2210, 2210 or 2240).

ENGP 3230 Quantum information Sci & Eng (3 Credit Hours)
This survey course introduces students to the new world of quantum information, quantum communication, and quantum computing. The course is intended for advanced undergraduates and beginning graduate students in physics, engineering, and mathematics. Topics include: Quantum states, operators, and linear algebra; Bits and qubits; Ensembles and density operators; Unitary transformations; Gates and circuits; Information and entropy; POVM measurement; Multipartite systems; Bell inequality, Bell states, and non-locality; Measures of entanglement; Quantum communication and cryptography; Teleportation; Superdense coding; Quantum noise and error correction; Classical and quantum computational complexity; Quantum algorithms: Deutsch-Jozsa, Grover, Shor; DiVincenzo criteria; Physical realizations of quantum computers: trapped ions, solid state qubits; Quantum optics and quantum internet; Topological quantum computation; Quantum biology.

Prerequisite(s): PHYS 2350 and (MATH 2210 or 2240).

ENGP 3290 Computational Materials Scienc (3 Credit Hours)
Computational Materials Science and Engineering: This course will cover theories, implementations, and applications of common quantum mechanical software for computational study of materials. State-of-the-art computational methods will be introduced for materials research with emphasis on the atomic and nano scales and hands-on modeling on PCs and supercomputers. The class is aimed at beginning graduate students and upper level undergraduate students, and will introduce a variety of computational methods used in different fields of materials science. The main focus is quantum mechanical methods with a short overview of atomistic methods for modeling materials. These methods will be applied to the properties of real materials, such as electronic structure, mechanical behavior, diffusion and phase transformations. Computational design of materials using materials database via high-throughput and machine learning methods will also be covered.

ENGP 3350 Kinetics of Material Systems (3 Credit Hours)
This course covers all aspects of kinetics in material systems. Topics include thermodynamics, steady state and time dependent diffusion, phase transformations, statistical mechanics, structure evolution, boundaries and interfaces, solidification, and precipitation effects.

Prerequisite(s): ENGP 3120.
ENGP 3360  Structure of Materials  (3 Credit Hours)

The properties of matter depend on which of the about 100 different kinds of atoms they are made of and how they are bonded together in different crystal structures; specifically, the atomic structure primarily affects the chemical, physical, thermal, electrical, magnetic, and optical properties of materials. Metals behave differently than ceramics, and ceramics behave differently than polymers. Students will learn the different states of condensed matter and develop a set of tools for describing the crystalline structure of all of them. They will gain a better understanding of the principles of structure common to all materials. Key concepts, such as symmetry theory will be introduced and applied to provide a common viewpoint for describing structures of ceramic, metallic, and polymeric materials and the latter includes optical microscopy, electron optics, x-ray diffraction and some surface analytical techniques. Structure-sensitive properties of real materials will also be introduced.

Prerequisite(s): ENGP 3120.

ENGP 3430  Prof Develop Engineers I  (2 Credit Hours)

This course is designed to inform students in engineering physics of the wide variety of career paths available in engineering and related fields, and help with development of professional skills essential for building a productive and fulfilling career. Overview of career profiles, portfolio building, elements of project management, economic analysis, professional certifications, intellectual property, entrepreneurship, ethics, research and professional communication.

Prerequisite(s): ENGP 3430.

ENGP 3530  Advanced Laboratory I  (3 Credit Hours)

Advanced experiments in modern physics and engineering, particularly nuclear physics and engineering, emphasizing research techniques and analysis of data using computers. Prerequisites: PHYS 2350 or approval of instructor.

Prerequisite(s): PHYS 2350, 2350, 2350 or 2350.

ENGP 3560  Photonic Materials & Devices  (3 Credit Hours)

This course will cover the theory, design, fabrication, characterization, and application of photonic materials and devices. The course will start with a review of the fundamentals of photonics, including ray optics, wave optics, and nanophotonics/quantum optics. The course will then focus on light-matter interactions and photonic materials, including dielectrics, semiconductors, metals, metamaterials, and photonic crystals. Using these principles and materials, we will explore a number of device architectures, including LEDs, lasers, photodetectors, photovoltaics, etc. We will then discuss fabrication methods for making these materials and devices and common optoelectronic characterization techniques. The course will conclude with exploration of cutting edge topics in photonics research. Prerequisites: PHYS 2350 and PHYS 2360 (or equivalent) or instructor approval.

Prerequisite(s): PHYS 2350 and 2360.

ENGP 3600  Nanoscience & Technology  (3 Credit Hours)

Nanoscience and technology is often branded the science of the 21st century. It has been promised that nanotechnology will have similar stimulating effects on the world’s economy and society as the industrial-and microelectronics-revolution. Nanoscience is an interdisciplinary effort with the aim to manipulate and control matter at length scales down to single molecules and atoms and thus to create materials and devices with novel properties. With diminishing dimensions material properties are being governed by quantum mechanics. The description and exploitation of quantum phenomena in novel devices is the quintessence of nanophysics. Consequently, the main emphasis of this course is to give an overview of the physics of low dimensional solid state systems. This course is supplementary to courses in solid state physics and surface science but can be taken independently. Prerequisites: PHYS 2350.

Prerequisite(s): PHYS 2350, 2350, 2350 or 2350.
ENGP 3620 MicroFab and Nanotech (3 Credit Hours)
Nanomicro-electromechanical devices (N/MEMS) require knowledge of a broad range of disciplines, from the fundamental physics of mechanics and electromagnetism to practical nano/microfabrication processes and techniques. This course is open for the introduction of this interdisciplinary engineering field, using examples and design projects drawn from real-world N/MEMS applications. Lectures will cover nano/microfabrication technologies, material properties at different scaling, physical principles and behavior of nano/microstructural behavior, piezoresistive and capacitive sensing, electrostatic actuation, fluid damping, noise, and feedback systems.

Prerequisite(s): PHYS 2360.

ENGP 3660 Special Topics (1-3 Credit Hours)
Special Topics.

ENGP 3665 Special Topics Lab (1-3 Credit Hours)
Special Topics Lab.

ENGP 3700 Electric Prop of Materls (3 Credit Hours)
Quantum physics, electronics and energy bands in crystals, electronic transport in materials, photoconductivity, Hall effect, quantum Hall effect, superconductors and their applications, magnetic properties of material and their applications, thermal properties of materials and dielectric properties of materials. Prerequisites: PHYS 2350, 2360 or instructor approval.

Prerequisite(s): (PHYS 2350, 2350, 2350 or 2350) and (PHYS 2360, 2360, 2360 or 2360).

ENGP 3720 Mechanic Behavior of Materials (3 Credit Hours)
The course covers the general foundations of elasticity and plasticity theory, dislocation theory, and strengthening mechanisms. Basics of materials forming processes are studied. An overview for non-destructive testing of materials is taught. The course emphasis is on destructive mechanical testing of materials including tension, torsion, hardness, fatigue and creep tests, in addition to fracture mechanics and failure analysis.

Prerequisite(s): (ENGP 3120 or 3120) and (ENGP 2430 or 2430) and (MATH 2210 or 2210).

ENGP 3760 Thermodynamics of Materials (3 Credit Hours)
The course covers the general foundation of both statistical thermodynamics and classical thermodynamics, including thermodynamics laws, auxiliary functions, and behavior of gases and solutions. In addition, special attention is dedicated to equilibria of reactions and phase diagrams of materials. Computer-based programs will be used to solve thermodynamics problems for complicated materials.

Prerequisite(s): ENGP 3120 and (MATH 2210, 2210, 2210 or 2210).

ENGP 3890 Service Learning: ENGP 3950 (0-1 Credit Hours)

ENGP 3940 Transfer Coursework (3 Credit Hours)

ENGP 3950 Engineers for Intl Deve (1 Credit Hour)
Engineers for International Development at Tulane University exists for students to participate in community-driven development programs worldwide through the design and implementation of sustainable engineering projects, while fostering responsible leadership. We work both internationally and locally to build and educate communities about their basic infrastructure systems such as drinking water, sanitation, and safe homes.

ENGP 4310 Team Dsgn Proj &Prf Pr I (3 Credit Hours)
Design project taken in the fourth year of study with student teams. Advanced treatment of engineering design principles and an introduction to manufacturing processes. Students are presented with a product specification, and they must prepare a preliminary proposal, form a project team and develop a suitable design. Prerequisites: ENGP 2020, 2310, or approval of instructor.

Prerequisite(s): (ENGP 2020, 2020, 2020 or 2020 and ENGP 2310, 2310, 2310 or 2310).

ENGP 4320 Team Dsgn Proj &Prf P II (3 Credit Hours)
Design project taken in the fourth year of study with student teams. Continuation of ENGP 4310. Notes: Capstone requirement for majors. Prerequisites: ENGP 4310 or approval of instructor.

Prerequisite(s): ENGP 4310.

ENGP 4660 Special Topics (1-3 Credit Hours)
Special Topics.

ENGP 4880 Writing Intensive: ENGP 4320 (1 Credit Hour)
Course to be attached to regular courses that incorporate a writing component within the regular course. Register within department.

ENGP 4890 Service Learning: ENGP 4320 (0-1 Credit Hours)

ENGP 4910 Independent Study (1-3 Credit Hours)
Independent Studies. Prerequisites: Approval of instructor and chair of department.
ENGP 4940  Transfer Coursework (3 Credit Hours)
ENGP 4990  Honors Thesis (3 Credit Hours)
Honors Thesis. Notes: Open only to candidates for honors degrees with departmental approval.

ENGP 5000  Honors Thesis (4 Credit Hours)
Honors Thesis. Notes: Open only to candidates for honors degrees with departmental approval.

ENGP 5380  Study Abroad (1-20 Credit Hours)
Courses taught abroad by non-Tulane faculty. Does not count toward Tulane GPA.

ENGP 5390  Study Abroad (1-20 Credit Hours)
Courses taught abroad by non-Tulane faculty. Does not count toward Tulane GPA.

ENGP 6660  Special Topics (1-3 Credit Hours)
Special Topics.

ENGP 6940  Transfer Coursework (1-4 Credit Hours)
Transfer Coursework.