The School of Science and Engineering

Engineering Physics

Office: 2001 Percival Stern Hall
Phone: (504) 865-5520
Fax: (504) 862-8702
Website:
http://www.physics.tulane.edu/StudentsEngPhysBS.shtml

This interdisciplinary program provides students with a broad science and mathematics background equal to that of Tulane's traditional physics major, combined with a strong grounding in engineering design and the application of physics principles to practical engineering problems. The curriculum is characterized by a strong emphasis on modern physics and its application to 21st century technology, including new materials, quantum electronics, nanofabrication, and devices. Our students will be well equipped to pursue research and development careers in new and emerging technologies that cut across traditional engineering and science disciplines, to pursue graduate studies in science or engineering, or to enter professional fields including law, management, and medicine. Graduates will have substantial experience with laboratory methods, data analysis, and computation. A centerpiece of the curriculum is the design sequence, consisting of a two-semester Introduction to Design sequence, a summer industry internship, and a two-semester capstone Team Design Project. As an intrinsic part of the curriculum, students develop strong oral and written communication skills, multidisciplinary teamwork skills, experience in public service, and knowledge about the high ethical standards of the engineering profession. The program builds on cross-cutting areas of research strength in the School of Science and Engineering, including: novel 21st century materials; materials for energy; biomolecular materials; macromolecules; "quantum mechanics to devices"; surfaces, interfaces, and nanostructures; and computation.

The major curriculum consists of the following requirements (90 credits total)

- Mathematics: Four MATH courses including MATH 221 (Calculus III) and MATH 224/424 (Introduction to Applied Mathematics or Ordinary Differential Equations), to be completed during the first two years of study (13 credits minimum)
- Basic Science: PHYS 131, 132 (General Physics I and II with lab) and CHEM 107, 117, 108, 118 (General Chemistry I and II with lab) taken in the first year of study, followed by PHYS 235, 236 (Modern Physics I and II) in the second year (22 credits)
- Introduction to Design I and II: ENGP 231-232, typically taken in the second year of study (6 credits)
- General Engineering Courses: ENGP 201 (Electric Circuits), CENG 212 (Thermodynamics I), ENGP 241 (Statics) and ENGP 243 (Mechanics of Materials) (12 credits)
- Materials Science and Engineering: ENGP 312 (3 credits)
- Advanced Laboratory: ENGP 353 (3 credits)
- Nanoscience and Technology: ENGP 360 (3 credits)
- Computation: ENGP 317 (Computational Physics and Engineering) or CENG 323 (Numerical Methods for Chemical Engineers) (3 credits)
- Seminar: PHYS 380 (1 credit)
- Contemporary topics: One course chosen from among PHYS 321 or 621, PHYS 327 or 627, PHYS 447, or PHYS 608 (3 credits)
- Classical topics: One course chosen from among PHYS 363, PHYS 374, PHYS 423, or PHYS 465 (3 credits)
- Engineering electives: Two courses chosen from among ENGP 344, CENG 211, CENG 232, CENG 250, BMEN 273, BMEN 323, and BMEN 330 (6 credits)
- Summer Design Internship: ENGP 331 (6 credits), taken in the summer following the third year of study
- Team Design Project and Professional Practice I and II: ENGP 431-432 (6 credits), taken in the fourth year of study

Many intermediate and advanced courses in the program have prerequisites listed under the Basic Science and Mathematics categories; several of the allowed electives may have additional prerequisites. Many of the required and elective courses may not be offered every year. Students must work closely with the

departmental undergraduate advisor to develop an individualized schedule of courses that fits their needs and interests, while satisfying all of the above requirements along with the university's core requirements for graduation.

ENGP 201 Electric Circuits 1 (3)
Prerequisites: MATH 122, PHYS 132 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.

ENGP 231 Introduction to Design I (3)
Staff. Introduction to principles of design.

ENGP 232 Introduction to Design II (3)
Staff. Introduction to principles of design. Continuation of ENGP 231.

ENGP 241 Statics (3)
Prerequisites: PHYS 131. Statics of particles and rigid bodies. Concepts of force, moments, free body diagrams, equilibrium and friction with engineering applications. Same as BMEN 241.

ENGP 243 Mechanics of Materials (3)
Prerequisites:ENGP 241, MATH 122. 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. Same as BMEN 243.

ENGP 312 Materials Science and Engineering (3)
Prerequisites: CHEM 107, CHEM 108, PHYS 131, PHYS 132, MATH 221. 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. Same as BMEN 312 and CENG 312.

ENGP 317 Computational Physics and Engineering (3)
Prof. Kaplan. Prerequisites: PHYS 235 and MATH 221 or 224. 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. Same as PHYS 317.

ENGP 331 Summer Design Internship (6
Staff. Industrial internship taken in the summer following the third year of study.

ENGP 344 Fluid Mechanics (3).
Staff. Prerequisites: ENGP 241, MATH 224. Fundamental concepts and properties of fluids. Basic equations of fluid statics and dynamics in differential and integral form using both system and control volume viewpoints. Topics and applications include dimensional analysis and similitude; ideal, viscous and compressible flows; pipe and boundary layer flow. Same as BMEN 344.

ENGP 353 Advanced Laboratory I (3)
Staff. Prerequisite: PHYS 235 or approval of instructor. Advanced experiments in modern physics and engineering, particularly nuclear physics and engineering, emphasizing research techniques and analysis of data using computers.

ENGP 360 Nanoscience and Technology (3)
Prof. Diebold. Prerequisite: PHYS 235. 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. Same as PHYS 360.

ENGP 431 Team Design Project and Professional Practice I (3)

Staff. Prerequisite: ENGP 231, 232, or approval of instructor.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.

ENGP 432 Team Design Project and Professional Practice II (3)

Staff. Prerequisite: ENGP 431 or approval of instructor. Design project taken in the fourth year of study with student teams. Continuation of ENGP 431.