ENGINEERING PHYSICS MAJOR

This interdisciplinary program provides students with a broad science and mathematics background similar 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. Focus areas in our department include: materials engineering, computational engineering, and nano 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.

Tulane's Engineering Physics program is accredited by the Engineering Accreditation Commission of ABET.

Mission Statement for Engineering Physics

The mission of our program is to provide the highest quality education for students in the principles and applications of Engineering Physics. The excellence of the program is ensured by our department's high regard for teaching, research activities and industrial ties. The program educates students to take leadership roles in industry, academia and government.

Educational Objectives for Engineering Physics Program

Our Engineering Physics program educates students to become professionals with a blend of in-depth knowledge and skills in mathematics, science, and engineering, enabling them to understand physical systems, research technical questions and pursue opportunities to innovate, design solutions, and solve problems. Our program provides the foundation for graduate study and lifelong learning. Our objective is to prepare graduates who can successfully pursue:

1. Professional careers at all levels in Engineering Physics or other professional pursuits where an engineering or physics background provides a valuable foundation. Examples of the latter are: focused engineering disciplines, medicine, law, and business administration.
2. Advanced studies in Engineering, Physical Sciences, or related fields.

Student Outcomes for Engineering Physics

Graduates of the Engineering Physics program at Tulane University will attain:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

Engineering Physics is a field that provides broad training in physics and mathematics and basic training in engineering and design. The practitioner of engineering physics is involved in the development of new devices and products using sophisticated physical concepts. The engineering physics curriculum educates students to work in areas where technology is changing rapidly and where the boundaries of several traditional engineering disciplines overlap, such as nanomaterials/devices, lasers, plasmas, robotics, materials, medical imaging, superconductors, and semiconductors. The curriculum develops sufficient depth in both engineering and science to produce graduates who are able to relate basic knowledge to practical problems in engineering. The engineering physicist is a person with the training of both an applied physicist and an engineer, the inclination to attack novel as well as routine problems in engineering, and the flexibility to exploit basic knowledge in any branch of science and technology using analytical and experimental skills.

Our engineering physics curriculum places emphasis on:

- basic principles of engineering
- problem solving

- mathematics
- physics
- engineering design
- computer science and engineering
- chemistry
- science and scientific principles
- research
- communications
- multi-disciplinary teamwork
- continuous learning
- leadership
- ethics
- preparation for advanced degrees in engineering and science

The required curriculum for engineering physics is relatively full. Class schedules should be carefully planned. Typical of engineering in the US, some engineering physics majors may take a course overload in some semesters.

Engineering Physics Certificates

The Engineering Physics program offers optional certificates for students who are interested in specific aspects of the broader program. Completing a certificate offers several advantages: structured/guided use of electives for focusing in a particular area, providing some depth within a broad-based ENGP curriculum; additional branding that may help students attract interest in industry after graduation; and preparation for common graduate engineering programs. Certificates are optional, but if a student does complete one, this is reported on the transcript. Students may choose one of four certificates:

- Computational Engineering (https://catalog.tulane.edu/science-engineering/physics-engineering/computational-engineering-certificate/)
- Electrical Engineering (https://catalog.tulane.edu/science-engineering/physics-engineering/electrical-engineering-certificate/)
- Materials Engineering (https://catalog.tulane.edu/science-engineering/physics-engineering/materials-engineering-certificate/)
- Mechanical Engineering (https://catalog.tulane.edu/science-engineering/physics-engineering/mechanical-engineering-certificate/)

with each having a pre-approved set of coursework that meets the requirements of that certificate. For more information and an up-to date-list of pre-approved electives, follow the links above and go to the "Requirements" section.

PEP Website
tulane.edu/sse/pep/academics/undergraduate/engineering-physics-program/ (https://sse.tulane.edu/pep/academics/undergraduate/engineering-physics/)

Requirements

General Course Requirements for Engineering Physics

The major curriculum consists of the following requirements (91 credits total plus Tulane Core Curriculum requirements):

Tulane University's Core Requirements for Graduation

Engineering Physics majors are exempt from the Newcomb-Tulane foreign language requirement. All other Newcomb-Tulane College core requirements must be fulfilled.

Course ID	Title	Credits
Mathematics		
Select four classes to be completed during the first two years of study including the following:		16
MATH 2210	Calculus III	4
MATH 2240 or MATH 4240	Intro To Applied Math Ordinary Differentl Equa	4
Basic Science First Year of Study		
PHYS 1310	General Physics I	4
PHYS 1320	General Physics II	4
CHEM 1070 & CHEM 1075	General Chemistry I and General Chemistry Lab I	4
Basic Science Second Year of Study		

PHYS 2350	Modern Physics I	3
PHYS 2360	Modern Physics II	3
Introduction to Design [1]		
ENGP 2020	Computing Concepts and Applications	4
ENGP 2310	Product and Experimental Design	3
General Engineering Courses		
ENGP 1410	Statics	3
ENGP 2010	Electric Circuits	3
ENGP 2011	Electric Circuits Lab	1
CENG 2120	Thermodynamics I	3
ENGP 3120	Materials Science and Engineering	3
Engineering Selected Elective		
Select one of the following:		
ENGP 2430	Mechanics of Materials	3
BMEN 2730	Biomedical Electronics	4
Advanced Laboratory		
ENGP 3530	Advanced Laboratory I	3
Computation		
Select one of the following:		3
ENGP 3170	Computnl Physics & Engr	3
CENG 3230	Numr Meth For Chem Eng	3
MATH 3310	Scientific Computing I	3
plus one additional 3-credit engineering elective for students choosing MATH 3310		3
Seminar		
PHYS 3800	Physics Colloquium	1
Contemporary Topics		
Select one of the following:		3
PHYS 3150	Intro To Neutron Science	3
or PHYS 6150	Intro To Neutron Science	
PHYS 3180	Introduction to Feedback Control and Control Theory	3
or PHYS 6180	Introduction to Feedback Control and Control Theory	
PHYS 3210	Molecular Biophysics & Polymer Physics	3
or PHYS 6210	Molec Biophysics & Polymer Phy	
PHYS 3230	Quantum Information Science & Engineering	3
or PHYS 6230	Quantum Information Sci & Eng	
PHYS 3310	Quantum Optics	3
or PHYS 6310	Quantum Optics	
PHYS 3450	Elementary Particle Physics	3
or PHYS 6450	Elem Particle Physics	
PHYS 3700	Electronic Properties of Materials	3
or PHYS 6700	Electrnc Prop of Materls	
PHYS 4470	Intro Quantum Mechanics	3
Classical Topics		
Select one of the following:		3
PHYS 3630	Electromagnetic Theory	3
PHYS 3740	Classical Mechanics	3
PHYS 4230	Thermal Physics	3
PHYS 4650	Optics	3
Engineering Electives		
Select four of the following:		12
CENG 2110	Matl & Energy Balances	3

CENG 2320	Transport I: Fluids	3
CENG 2500	Intro To Biotechnology	3
CENG 3110	Thermodynamics II	3
CENG 3390	Transport II: Heat and Mass	3
ENGP 2420	Engineering Dynamics	3
ENGP 3290	Computational Materials Scienc	3
ENGP 3350	Kinetics of Material Systems	3
ENGP 3360	Structure of Materials	3
ENGP 3370	Processing of Biomaterials	3
ENGP 3380	Materials for Energy	3
ENGP 3390	Synthesis of Nanomaterials	3
ENGP 3560	Photonic Materials & Devices	3
ENGP 3570	Semiconductor Devices	3
ENGP 3600	Nanoscience & Technology	3
ENGP 3620	MicroFab and Nanotech	3
ENGP 3660	Special Topics	1-3
ENGP 3720	Mechanic Behavior of Materials	3
ENGP 3760	Thermodynamics of Materials	3
BMEN 3400	Biomaterials & Tissue Engineering	3
BMEN 3440	Biofluid Mechanics	3
BMEN 3650	Biomechanics and Biotransport	3
BMEN 3730	Biomedical Signals and Systems	3
BMEN 3820	Math Analysis Bio Systms	3
BMEN 3932	Elements of BMEN Design	3
CMPS 3350	Intro to Computer Graphics	3
or other courses as approved by the Faculty Advisor		
Professional Development		
ENGP 3430 & ENGP 3440	Prof Develop Engineers I and Prof Develop Engineers II [2]	3
Summer Internship		
Normally done in the summer following the third year of study		0
Team Design Project and Professional Practice [3]		
ENGP 4310	Team Design Project & Prf Pr I	3
ENGP 4320	Team Design Project & Prf P II	3
Total Credits Required for Major		**91**

1 Typically taken in the second year of study
2 Normally taken in the junior year
3 Taken in the fourth year of study

Note:

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.

ROTC Courses

ROTC courses, if elected, are taken in addition to the normal courses. Please see the Engineering Physics advisor for details.

Sample Schedule of Classes for Engineering Physics

Year 1

Fall		**Credit Hours**
CHEM 1070 & CHEM 1075	General Chemistry I and General Chemistry Lab I	4
PHYS 1310	General Physics I	4
PHYS 1311	General Physics I Lab	0
MATH 1210	Calculus I	4
ENGL 1010	Writing	4
TIDES Course Credits		1
	Credit Hours	**17**
Spring		
PHYS 1320	General Physics II	4
PHYS 1321	General Physics II Lab	0
MATH 1220	Calculus II	4
ENGP 1410	Statics	3
ENGP 2020	Computing Concepts and Applications	4
	Credit Hours	**15**

Year 2

Fall		
PHYS 2350	Modern Physics I	3
MATH 2210	Calculus III	4
ENGP 2010	Electric Circuits	3
ENGP 2011	Electric Circuits Lab	1
ENGP 2310	Product and Experimental Design	3
Tier 1 Service Learning		1
	Credit Hours	**15**
Spring		
PHYS 2360	Modern Physics II	3
MATH 2240	Intro To Applied Math	4
ENGP 3120	Materials Science and Engineering	3
Engineering Selected Elective [1]		4
Cultural Knowledge Elective 1		3
	Credit Hours	**17**

Year 3

Fall		
ENGP 3430	Prof Develop Engineers I	2
PHYS 3800	Physics Colloquium	1
Classical Physics Elective [2]		3
Cultural Knowledge Elective 2		3
Two Engineering Electives [3]		6
	Credit Hours	**15**
Spring		
ENGP 2120	Thermodynamics I	3
ENGP 3170	Computnl Physics & Engr	3
ENGP 3530	Advanced Laboratory I	3
Engineering Elective [4]		3
Cultural Knowledge Elective 3		3
	Credit Hours	**15**

Year 4		
Fall		
ENGP 4310	Team Design Project & Prf Pr I	3
Engineering Elective [5]		3
Cultural Knowledge Elective 4		3
General Elective		3
	Credit Hours	**12**
Spring		
ENGP 4320	Team Design Project & Prf P II	3
Contemporary Physics Elective [6]		3
Cultural Knowledge Elective 5		3
Tier 2 Service Learning		1
General Elective		4
	Credit Hours	**14**
	Total Credit Hours	**120**

1 Choose either BMEN 2730 Biomedical Electronics (4 c.h.) (spring class) or ENGP 2430 Mechanics of Materials (3 c.h.) (fall class).
2 e.g.,PHYS 3630 Electromagnetic Theory (3 c.h.)
3 e.g., BMEN 3440 Biofluid Mechanics (3 c.h.), ENGP 2420 Engineering Dynamics (3 c.h.)
4 e.g., ENGP 3620 MicroFab and Nanotech (3 c.h.)
5 e.g., ENGP 3360 Structure of Materials (3 c.h.)
6 e.g., PHYS 4470 Intro Quantum Mechanics (3 c.h.)