Engineering Science (ENGR)

Office: Suite 200, Lindy Claiborne Boggs Center

Phone: (504) 865-5764

Fax: (504) 862-8747

Website: www.eng.tulane.edu/Engsci/ENSC_Main.html

Engineering Science is an innovative, interdisciplinary program in which the student first acquires a core body of knowledge in basic mathematics, science, and engineering; and then uses this knowledge to develop expertise in a specialized area of concentration. The specialty option is individually designed for each student. Typical choices include business, public policy, applied mathematics, and environmental management.

An undergraduate engineering education is recognized as an excellent foundation for professions such as medicine, technical management, and patent law. The Major in Engineering Science, with its flexibility, provides the opportunity for a student to obtain this foundation while developing a non-engineering specialization as an undergraduate student. Engineering Science is administered by the Engineering Science Committee. Program courses may be selected from the offerings of the university faculty at large and depend upon the student’s individual interests and the course prerequisites.

Tulane University is accredited by the Commission on Colleges of the Southern Association of Colleges and Schools (SACS) to award bachelor’s, master’s, and doctoral degrees. This is the University’s primary accreditation, and it is important because it enables our students to qualify for many forms of financial aid that are available only to students at accredited universities and colleges.

The Engineering Science program has not requested ABET accreditation, since the individual variability of the curriculum makes it hard to fit into the fields for which ABET has set standards. The program’s strength and advantage is the flexibility in specialization it provides. Engineering Science majors not only design their own program—they also name them. When choosing a major, either in Engineering or in another field, the student’s primary concern should be finding programs that fit their interest, talents, and life goals. The University’s reputation, and our graduates’ record of accomplishment, define our students’ credentials after graduation.

Mission

The faculty affiliated with the Engineering Science Program strive to provide the highest quality education and research opportunities for our students. We expect and value excellence in teaching undergraduate and graduate courses, conducting research, and training students to participate in research activities and professional practice.

We accomplish our mission and we endorse the core values of Tulane University as follows:
• Through the scholarship of discovery, we develop, integrate, and apply new ideas through innovative, interdisciplinary research approaches.

• Through the scholarship of learning, we develop the knowledge and skills necessary to participate in engineering analysis, design and research.

• Through the scholarship of service, we share knowledge to advance the opportunities and the significance of engineering in efforts that ultimately improve the quality of life.

**Objectives**

Our Program Instructional Objectives are designed to yield an environment where students take active control of, and exhibit pride in, their education. They view the School of Engineering and Tulane University as learning-oriented communities and themselves as integral parts of those communities; and they develop the broad base of critical thinking abilities, technical knowledge, and engineering skills crucial to professional practice in Engineering and related careers.

**Program Instructional Objectives:** We give our students strong foundations in engineering, mathematics, and a specialized area of concentration, in a coherent and coordinated curriculum. We provide our students with individual opportunities to conduct focused research or design projects in areas of professional interest, and we prepare our students for a successful transition to advanced study and professional careers. Specifically, students who obtain a bachelor’s degree in Engineering Science will be able to:

• Understand and apply principles and tools of mathematics, science, and engineering to formulate and analyze problems, specializing in issues found in their area of interest.

• Compose and test hypotheses, and interpret resulting data.

• Design systems, devices and processes to meet designated specifications or open-ended objectives; evaluate and justify the resulting designs within contemporary cultural and broad societal contexts.

• Work effectively in multidisciplinary teams.

• Exemplify professionally and ethically responsible conduct.

• Seek and value opportunities for extracurricular and postgraduate education and development.

• Communicate the short- and long-term challenges and opportunities in the field of Engineering to both technical colleagues and the general public.

**Curriculum**

**Freshman Year**

*Fall Semester*  
**Credits**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 107/117</td>
<td>General Chemistry I</td>
<td>4</td>
</tr>
<tr>
<td>CPSC 101</td>
<td>Software Design &amp; Programming</td>
<td>4</td>
</tr>
</tbody>
</table>
MATH 121 Calculus I 4
PHYS 131 Physics I 4
ENGR 100 Engr Seminar I 1
Fall Semester Total: 17

Spring Semester
CHEM 108/118 General Chemistry II 4
ENGL 101 Writing 4
MATH 122 Calculus II 4
PHYS 132 Physics II 4
ENGR 101 Engr Seminar II 1
Spring Semester Total: 17

Sophomore Year
Fall Semester
MATH 221 Calculus III 4
ENGR 241 Statics 3
ENGR 213 Thermodynamics 3
MCEN 264 Materials Engineering 4
Elective Humanities or Social Science 3
Fall Semester Total: 17

Spring Semester
MATH 224 Introduction to Applied Mathematics 4
ENGR 242 Dynamics 3
ENGR 243 Mechanics of Materials 3
CENG 221 Probability & Statistics 3
Elective Humanities or Social Science 3
Spring Semester Total: 16

Junior Year
Fall Semester
ENGR 344 Fluid Mechanics 3
ENGR 201 Elec. Circuits I 3
MCEN 201 Computer Aided Engineering 3
Elective Humanities or Social Science 3
Elective Humanities or Social Science 3
Fall Semester Total: 15

Spring Semester
MCEN 229 Engineering Design 3
MCEN 302 Heat Transfer 3
MCEN 371 Mechanical Engineering Lab 4
ENGR 490 Research & Professional Practice I2
Elective Option 3
Spring Semester Total: 14

Senior Year
Fall Semester
ENGR 403 Team Design Projects I 2
ENGR 491 Research & Professional Practice II 2
Elective Option 3-4
Elective Option 3-4
Elective Engineering Science 3
Elective Humanities or Social Science 3
Fall Semester Total: 16-18

Spring Semester
ENGR 404 Team Design Projects II 2
Elective Option 3-4
Elective Option 3-4
Elective Option 3-4
Elective Humanities or Social Science 3

Spring Semester Total: 14-17

The 6 Option Electives can be taken in any combination during any semester(s). The semester-by-semester distribution of Option Electives and Humanities or Social Science Electives is a suggestion only.

Note:
- CPSC 116 [Software Design and Programming] may be substituted for CPSC 101.
- BMEN 102 [Elements of BME Design] may be substituted for ENGR 101.
- ENGR 312 [Materials Engineering] may be substituted for MCEN 264.
- CENG 212 [Thermodynamics I] may be substituted for ENGR 213.

Special-Option Curriculum

The focused concentration in a field of specialization is listed in the curriculum as “Option Electives.” It is this part of the Engineering Science Major that provides the opportunity for students to emphasize areas of study not possible in traditional engineering curricula. Courses selected by the student with the approval of the advisor are designed to develop the student’s ability to apply pertinent knowledge in identifying and solving practical engineering problems in his or her special field. In addition to the Option Electives, at least six courses in the Humanities and Social Sciences are required, and 1 additional elective must be selected from courses in engineering sciences.

Minor in Engineering Science

Students in divisions outside of the School of Engineering may earn a Minor in Engineering Science through completion of the following sequence of courses. This minor is unavailable to students in the School of Engineering.

I. Prerequisite LAS Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 121</td>
<td>Calculus I</td>
<td>4</td>
</tr>
<tr>
<td>MATH 122</td>
<td>Calculus II</td>
<td>4</td>
</tr>
<tr>
<td>MATH 221</td>
<td>Calculus III</td>
<td>4</td>
</tr>
<tr>
<td>MATH 224</td>
<td>Introduction to Applied Mathematics</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 107/117</td>
<td>General Chemistry I and II</td>
<td>4, 4</td>
</tr>
<tr>
<td>or PHYS 131;</td>
<td>General Physics I and II</td>
<td>4, 4</td>
</tr>
<tr>
<td>PHYS 132</td>
<td></td>
<td>24</td>
</tr>
</tbody>
</table>

II. School of Engineering Courses

Required of all Engineering Science minors:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGR 100</td>
<td>Seminar</td>
<td>1</td>
</tr>
<tr>
<td>MCEN 229</td>
<td>Engineering Design</td>
<td>3</td>
</tr>
<tr>
<td>Elective</td>
<td>300 - 400 level elective in Engineering</td>
<td>3</td>
</tr>
</tbody>
</table>

Plus one course chosen from the following lists:
CPSC 103  Introduction to Computing via Pascal  3
CPSC 101  Software Design and Programming  4
MCEN 201  Computer Aided Engineering  3
BMEN 201  Experiments and Experimental Design  3
CVEN 207  Introduction to Environmental Studies  3

And three courses (9 credits) chosen from the following lists:
(appropriate for students who have taken PHYS 131 and PHYS 132)

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGR 201</td>
<td>Electric Circuits I</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 241</td>
<td>Statics</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 242</td>
<td>Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 243</td>
<td>Mechanics of Materials</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 344</td>
<td>Fluid Mechanics</td>
<td>3</td>
</tr>
</tbody>
</table>

(appropriate for students who have taken CHEM 107/117 and CHEM 108/118)

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGR 201</td>
<td>Electric Circuits I</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 213</td>
<td>Thermodynamics</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 312</td>
<td>Materials Science and Engineering</td>
<td>3</td>
</tr>
<tr>
<td>MCEN 302</td>
<td>Heat Transfer</td>
<td>3</td>
</tr>
</tbody>
</table>

**Course Descriptions**

**ENGR 100, ENGR 101 Introduction to Engineering and Computer Science (1) Seminar 1.**
The objectives of ENGR 100 seminar are to familiarize each student with the profession and various fields of engineering and computer science, to assure that each student is confident in their choice of major, to inform each student of what will be expected of them before and after graduation, and to begin to build the skills necessary for success. The ENGR 101 seminars are designed to bring these objectives into sharp focus for each specific major program.

**ENGR 201 Electric Circuits 1 (3) Lecture 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.

**ENGR 213 Thermodynamics (3) Lecture 3.**
Prerequisites: MATH 122, PHYS 131. The basic laws of thermodynamics are formulated for application to a representative series of engineering processes. The course covers thermodynamic concepts and definitions, properties of materials, work and heat, first and second laws of thermodynamics, entropy.

**ENGR 241 Statics (3) Lecture 3.**
Prerequisite: PHYS 131. Statics of particles and rigid bodies. Concepts of force, moments, free body diagrams, equilibrium and friction with engineering applications.

**ENGR 242 Dynamics (3) Lecture 3.**

**ENGR 243 Mechanics of Materials (3) Lecture 3.**
Prerequisites: ENGR 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.
ENGR 247 Mechanics: Statics and Dynamics (4).
Prerequisites: MATH 122, PHYS 131. This course covers primarily the statics portion of mechanics including forces and moments, equilibrium of force systems in two and three dimensions, multi-force members, friction, and the equilibrium analysis of trusses, frames, and machines. Topics in dynamics include the kinematics and kinetics of particles and rigid bodies, work and energy, impulse and momentum.

ENGR 312 Materials Science and Engineering (3) Lecture 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.

ENGR 344 Fluid Mechanics (3) Lecture 3.
Prerequisites: ENGR 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.

ENGR 403, ENGR 404 Team Design Projects I and II (2, 2).
Prerequisite: Senior standing. Techniques and experience in the solution of constrained and open-ended design problems. Lecture topics include all aspects of the design process, including goal setting, idea generation, prototyping, facrication, and product and evaluation. Also included are technical presentation, project planning and management. Included as needed are other topics such as standards, fastening and joining, motors and control, esthetics and finish. Each team will design and construct a device or system to assist an individual with a disability. These designs are presented in a public show during the second semester.

ENGR 451 Engineering Economics (2) Lecture 2.
Coverage includes principles for economic decision making, economic feasibility, applications to engineering projects. Topics include the time value of money, interest, present and future worth, cash flow, rate of return, cost-benefits analysis, depreciation, inflation, and taxation.

ENGR 490, ENGR 491 Research and Professional Practice I and II (2, 2).
This course introduces the tools, techniques, and rules necessary to function professionally as a researcher or engineer. Topics include economic analysis, ethics, professional communication including writing and oral presentation, research techniques including literature searching, citation, and the structure of a scientific paper. An integral part of the course is a year-long research or design project under the direction of a faculty member or other scientist or professional. This culminates in a Senior Thesis and a presentation in Departmental Seminar.

ENGR 600 Entrepreneurship in Engineering (3) Lecture 2.
This course examines the role, and more significantly, the decision making process of the high tech engineer/entrepreneur within the business community. The class model will include taking a novel idea through the entire business cycle, from an idea through the start-up, developing into a domestic and international company, and finally through bankruptcy.

Note: Additional upper level ENGR courses are cross-listed in the departmental listings. For example, the description of ENGR 636 Introduction to the Finite Element Method may be found cross-listed as BMEN 636 Introduction to the Finite Element Method.