6. College of Engineering

The College of Engineering offers six Bachelor of Science (B.S.) degree programs in: Biomedical Engineering (BME); Chemical Engineering (CME), Civil Engineering (CE); Computer Engineering (CPE); Electrical Engineering (EE); and Mechanical Engineering (ME). The College of Engineering programs in Biomedical Engineering, Civil Engineering, Computer Engineering, Electrical Engineering, and Mechanical Engineering are accredited by the Engineering Accreditation Commission of ABET (http://www.abet.org). Chemical Engineering is a newly established program and will seek accreditation following graduation of their first class per ABET policy.

The College has excellent laboratory facilities where students receive hands-on instruction by faculty. Computer-aided design (CAD) facilities, including state-of-the-art workstations, are routinely used in all programs. Some classes are taught by adjunct faculty from local industries, giving students the opportunity to interact with engineering professionals engaged in relevant engineering practice.

College Honors

The College of Engineering designates certain of its outstanding students as Honors students and provides the opportunity for advanced study under close faculty supervision. Selection for the honors designation is based on the student’s academic performance and recommendation by a faculty member in the student’s major discipline. To be eligible for the program, students must have a minimum UTSA grade point average of 3.25 and a minimum grade point average of 3.25 in their major at UTSA. These minimum averages must be maintained by the student to receive approval of the College Honors Committee. Students applying for College Honors must enroll in EGR 4993 Honors Research during their final two semesters. The completed research paper must be approved by the supervising faculty sponsor and by at least one of the faculty members in the student’s major discipline. Students interested in this program should contact a faculty advisor for additional information.

Admission to the College of Engineering

Admission Policy for Students Admitted Under this Catalog Prior to Fall 2019

Freshmen and Freshman Transfer Students

Students must complete the following admission requirements for freshmen or freshman transfer students (freshman transfers are transfer students who have earned fewer than 30 hours):

- qualify for enrollment in MAT 1214 Calculus I, or a higher level mathematics course, and
- qualify for enrollment in WRC 1013 Freshman Composition I (Q) or higher, or
- if a freshman transfer student, must have completed MAT 1214 Calculus I and WRC 1013 Freshman Composition I (Q) with grades of “C-” or better and have at least a 2.50 overall and STEM (math, science, and engineering) grade point average.

Admission to the College of Engineering is competitive and not guaranteed.

Transfer Students

The following are the transfer requirements for direct admission to the College of Engineering for transfer students who have earned 30 or more credit hours:

- completed MAT 1214 Calculus I, or the equivalent with a grade of “C-” or better, and
- meet grade point average requirements:
  - a. Have a transfer grade point average of at least 2.50 and a grade point average of at least 2.50 in all mathematics, sciences, and engineering coursework, or
  - b. Have a transfer grade point average of at least 2.25 and a grade point average of at least 2.25 in all mathematics, sciences, and engineering coursework, and be granted admission to the College of Engineering major by holistic review by the College.

Transfer students not admitted directly into the College of Engineering will be changed to Undeclared (UND) and must choose another major outside of engineering. Additional admission requirements are needed for the biomedical and chemical engineering majors and are listed under their respective program requirements.

Admission Policy for Students Admitted Under this Catalog Beginning Fall 2019

Freshmen

Freshman applicants must complete the following admission requirements for direct admission to the College of Engineering:

- meet all UTSA undergraduate admission requirements, and
- are ranked in the top 10 percent of their high school class, qualify for enrollment in MAT 1214 Calculus I, or a higher level mathematics course, and have successfully completed evaluation under the Texas Success Initiative (TSI) for unencumbered registration for courses, or
- are ranked in the top 50 percent of their high school class, have a minimum 1170 SAT* or 24 ACT score, and qualify for enrollment in MAT 1214 Calculus I, or a higher level mathematics course.

* New SAT scores combine Evidence-Based Reading and Writing and Math.

Admission to the College of Engineering is competitive and not guaranteed. Freshmen who do not meet the above requirements, but meet UTSA’s general admission requirements will be part of “Engineering, Math and Sciences Studies” where students will be able to work towards meeting the prerequisites needed to declare Civil, Computer, Electrical or Mechanical Engineering as their major.

Transfer Students

The following are the transfer requirements for direct admission to the College of Engineering:

- completed MAT 1214 Calculus I, or the equivalent with a grade of “C-” or better, and
- completed WRC 1013 Freshman Composition I (Q) with a grade of “C-” or better, and
- have a transfer grade point average of at least 2.50 and a grade point average of at least 2.50 in all mathematics, sciences, and engineering coursework.
The following are the transfer requirements for admission by committee review to the College of Engineering:

- completed MAT 1214 Calculus I, or the equivalent with a grade of "C-" or better, and
- completed WRC 1013 Freshman Composition I (Q) with a grade of "C-" or better, and
- have a transfer grade point average of at least 2.25 and a grade point average of at least 2.25 in all mathematics, sciences, and engineering coursework.

Transfer students not admitted directly into the College of Engineering will be changed to Undeclared (UND) and must choose another major outside of engineering. Additional admission requirements are needed for the biomedical and chemical engineering majors and are listed under their respective program requirements.

“C-” Grade Rule

A grade of "C-" or better in any science, engineering or mathematics course required for an engineering degree or any other course that is a prerequisite to a required Biomedical Engineering (BME), Chemical Engineering (CME), Civil Engineering (CE), Computer Engineering (CPE), Electrical Engineering (EE), Mechanical Engineering (ME), or Engineering (EGR) course indicates satisfactory preparation for further engineering education. Any course assigned a grade below a "C-" must be repeated before enrolling in any course for which it is a prerequisite. This requirement is subject to both the Gateway Course and Three-Attempt Limit rules.

Gateway Course

Students pursuing a degree in the College of Engineering must successfully complete MAT 1214 Calculus I, the Gateway Course, with a grade of "C-" or better in no more than two attempts. A student who is unable to successfully complete this course within two attempts, including dropping the course with a grade of "W" or taking an equivalent course at another institution, will be required to change his or her major outside of engineering.

Three-Attempt Limit for the College of Engineering

A student unable to achieve the "C-" Grade Rule within three enrollments (attempts) shall be required to change his or her major to a field outside of the College of Engineering. Dropping a course with a grade of "W" is considered an attempt.

Cooperative Education in Engineering Program

The Cooperative Education in Engineering Program formally integrates University studies with institutionally supervised work experiences at cooperating organizations. Students participating in this program alternate periods of study at the University with periods of employment in industry. This combination of experiences enhances the student’s knowledge, personal development, and preparation for a professional career. Participants register at the University each semester. During the work periods, students register for the 3-semester-credit-hour EGR 3303 Engineering Co-op course. At the end of each work period, students submit reports covering the period. These reports are the basis of the student’s grades in the course. The cooperative education work periods also provide students with a source of income to help pay for their college expenses.

To qualify for the Cooperative Education in Engineering Program, a student must have declared a major in the College of Engineering and have a minimum cumulative grade point average of 2.50 and a minimum grade point average of 2.50 in their College of Engineering courses. Students are advised that many co-op employers require cumulative grade point averages higher than 2.50, and some require a minimum cumulative grade point average of 3.0. Transfer students may participate in the program after completing at least one semester at UTSA.

For more information and to apply to the Cooperative Education in Engineering Program, students should contact their faculty mentor.

Degree Requirements Common to All Engineering Programs

During their first semester, students should specify their interest in a specific engineering program by selecting biomedical, chemical, civil, computer, electrical, or mechanical engineering as a major. Undecided engineering students should select a major closest to their area of interest (refer to the following program descriptions). Students may obtain additional information about each program from their academic advisor or a faculty advisor in the appropriate department.

Students must satisfy the University’s Core Curriculum and ABET accreditation requirements. Recommended degree plans and current ABET requirements may be obtained from the College of Engineering. All students admitted to the College of Engineering must complete at least 42 semester credit hours from their required major courses at UTSA before graduation.

Course requirements common to all engineering degree programs follow.

I. Core Curriculum requirements

Students seeking the Bachelor of Science degree in any engineering field must fulfill University Core Curriculum requirements in the same manner as other students at UTSA.

MAT 1214 Calculus I, PHY 1943 Physics for Scientists and Engineers I, and PHY 1963 Physics for Scientists and Engineers II (also listed under section II. General Engineering requirements) may be used to satisfy the Core Curriculum requirements for Mathematics and Life and Physical Sciences.

II. General Engineering requirements

All degree-seeking candidates in engineering must complete the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHE 1103</td>
<td>General Chemistry I</td>
<td>3</td>
</tr>
<tr>
<td>EGR 2323</td>
<td>Applied Engineering Analysis I</td>
<td>3</td>
</tr>
<tr>
<td>MAT 1214</td>
<td>Calculus I</td>
<td>4</td>
</tr>
<tr>
<td>MAT 1224</td>
<td>Calculus II</td>
<td>4</td>
</tr>
<tr>
<td>or EGR 1324</td>
<td>Calculus II for Engineers</td>
<td></td>
</tr>
<tr>
<td>PHY 1943</td>
<td>Physics for Scientists and Engineers I</td>
<td>4</td>
</tr>
<tr>
<td>&amp; PHY 1951</td>
<td>and Physics for Scientists and Engineers I Laboratory</td>
<td></td>
</tr>
</tbody>
</table>
Certificate in Data Center Design

The certificate program in Data Center Design is designed so that students in mechanical, civil, and electrical engineering disciplines will take all the required courses in their disciplines, then, take additional courses from other majors (options A, B and C shown below). For instance, in order to be certified, a mechanical engineering student not only has to satisfy the mechanical engineering degree requirements, but also needs to complete courses in option A, shown below. All students must satisfy the prerequisites for courses in the option before registering for courses. Regardless of the option, all participating students must complete a 3 semester credit hour data center design project. The following exhibits the description of the project:

EGR 4953 Special Studies in Engineering: Overview of Data Center Design and Operation

The goal of this course is to provide the student with a broad overview of the application of technical course material and to utilize that knowledge in completion of an approved data center project. The scope of the project encompasses all of the requisite phases in planning for a system deployment into a data center. The phases are: planning, requirement analysis, facility design and installation, system deployment, check out and transitioning to operations. Students should propose the projects, an advisor will be assigned (either from UTSA or industry), and the project will be evaluated as the principal element of the student’s grade. Additionally, the course will include field trips to data centers, and guest lecturers to be provided. Some examples of the lecture topics include: Information Technology set up considerations, PSC management and systems monitoring, fire protection/detection at room and cabinet level, future power projections for servers and high performance computers, future cooling applications, physical security measures, etc. Successful course completion includes completing a class project and project presentation.

Option A. Mechanical Engineering Students

Requires 15 semester credit hours in addition to the B.S. in Mechanical Engineering degree requirements. Mechanical Engineering students pursuing a certificate in Data Center Design must complete the following courses:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>EGR 4953</td>
<td>Special Studies in Engineering (Overview of Data Center Design and Operation)</td>
<td>3</td>
</tr>
<tr>
<td>ME 4293</td>
<td>Thermodynamics II</td>
<td>3</td>
</tr>
<tr>
<td>ME 4313</td>
<td>Heat Transfer</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Credit Hours 15

Option B. Civil Engineering Students

Requires 21 semester credit hours in addition to the B.S. in Civil Engineering degree requirements. Civil Engineering students pursuing a certificate in Data Center Design must complete the following courses:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>EE 2213</td>
<td>Electric Circuits and Electronics</td>
<td>3</td>
</tr>
<tr>
<td>EE 3413</td>
<td>Analysis and Design of Control Systems</td>
<td>3</td>
</tr>
<tr>
<td>EE 4953</td>
<td>Special Studies in Electrical and Computer Engineering (Power Electronics)</td>
<td>3</td>
</tr>
<tr>
<td>EGR 4953</td>
<td>Special Studies in Engineering (Overview of Data Center Design and Operation)</td>
<td>3</td>
</tr>
<tr>
<td>ME 3293</td>
<td>Thermodynamics I</td>
<td>3</td>
</tr>
<tr>
<td>ME 4293</td>
<td>Thermodynamics II</td>
<td>3</td>
</tr>
<tr>
<td>ME 4313</td>
<td>Heat Transfer</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Credit Hours 21

Option C. Electrical Engineering Students

Requires 18 semester credit hours in addition to the B.S. in Electrical Engineering degree requirements. Electrical Engineering students pursuing a certificate in Data Center Design must complete the following courses:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>EE 4953</td>
<td>Special Studies in Engineering (Overview of Data Center Design and Operation)</td>
<td>3</td>
</tr>
<tr>
<td>ME 3293</td>
<td>Thermodynamics I</td>
<td>3</td>
</tr>
<tr>
<td>ME 3663</td>
<td>Fluid Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>ME 4293</td>
<td>Thermodynamics II</td>
<td>3</td>
</tr>
<tr>
<td>ME 4313</td>
<td>Heat Transfer</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Credit Hours 18

Engineering (EGR) Courses

EGR 1313. Calculus with Engineering Applications. (3-2) 3 Credit Hours.
Prerequisite: Completion of precalculus or satisfactory performance on a placement examination. The first of a two-part integrated physics and calculus course. Calculus topics include an introduction to the concepts of limit, continuity, and derivative, mean value theorem, and applications of derivatives such as velocity and acceleration; introduction to the Riemann integral and the fundamental theorem of calculus. Physics topics include an introduction to vectors, force and Newton’s Laws of Physics. Classes meet weekly for three hours of lecture and two hours of problem solving tutorials. Course Fees: LRE1 $20; STSE $30.

EGR 1324. Calculus II for Engineers. (4-0) 4 Credit Hours. (TCCN = MATH 2414)
Prerequisite: MAT 1214. Methods of integration, applications of the integral, sequences, series, and Taylor expansions. Calculus topics are combined with physics applications including an introduction to vectors, parametric equations, gradients, and Newton’s Laws of Physics. (Credit cannot be earned for both EGR 1324 and MAT 1224.) Course Fees: LRE1 $20; STSE $40.
EGR 1343. The Impact of Modern Technologies on Society. (3-0) 3 Credit Hours.
Prerequisites: Basic background in high school mathematics and physical sciences. This course is designed to inform students of the social impact of modern technologies. The course explores the issues faced by society as technology becomes an integral part of human life. The course prepares students to think critically, practically, creatively and responsibly about technological and sociological challenges, and encourages them to examine solutions of their own. The course also explores and discusses the socio-technological interplay. May be applied toward the core curriculum requirement in Social and Behavioral Sciences. Course Fees: LRC1 $12; LRE1 $20; STSE $30.

EGR 1403. Technical Communication. (3-0) 3 Credit Hours.
Prerequisite: WRC 1013. Oral, written, graphical and visual communication; technical instructions; design project with presentation; team-work; and personal responsibility. May be applied toward the Core Curriculum requirement in the Component Area Option. Course Fees: LRC1 $12; LRE1 $20; STSE $30.

EGR 2103. Statics. (3-0) 3 Credit Hours. (TCCN = ENGR 2301)
Prerequisites: PHY 1943, and completion of or concurrent enrollment in MAT 1224. Vector analysis of force systems applied to particles and rigid bodies and free body diagrams. Engineering applications of equilibrium; of moments, internal forces, and friction; and of centroids, centers of gravity, and moments of inertia. Generally offered: Fall, Spring, Summer. Course Fees: LRE1 $20; STSE $30.

EGR 2213. Statics and Dynamics. (3-0) 3 Credit Hours. (TCCN = ENGR 2303)
Prerequisites: MAT 1224 and PHY 1943. Force, moment, equilibrium, centroids and moments of inertia, kinematics, and kinetics of particles. Not open to students in Civil or Mechanical Engineering. May not be substituted for EGR 2103. Generally offered: Fall, Spring, Summer. Course Fees: LRE1 $20; STSE $30.

EGR 2323. Applied Engineering Analysis I. (3-1) 3 Credit Hours. (TCCN = MATH 2321)
Prerequisite: MAT 1224 or EGR 1324. Application of mathematical principles to the analysis of engineering problems using linear algebra and ordinary differential equations (ODE’s). Topics include: mathematical modeling of engineering problems; separable ODE’s; first-, second-, and higher-order linear constant coefficient ODE’s; characteristic equation of an ODE; non-homogeneous equations; Laplace transforms; shifting theorems; convolution; solution of an ODE via Laplace transform; matrix addition and multiplication; solution of a linear system of equations via Gauss elimination and Cramer’s rule; rank, determinant, and inverse of a matrix; eigenvalues and eigenvectors; existence and uniqueness of solutions; solution to system of ODE’s by diagonalization. One hour of problem solving recitation. Generally offered: Fall, Spring, Summer. Course Fees: LRE1 $20; STSE $30.

EGR 2513. Dynamics. (3-0) 3 Credit Hours. (TCCN = ENGR 2302)
Prerequisite: EGR 2103. Kinetics of particles and plane rigid bodies, work and energy, impulse and momentum, equations of motion and engineering applications. Generally offered: Fall, Spring, Summer. Course Fees: LRE1 $20; STSE $30.

EGR 3303. Engineering Co-op. (0-0) 3 Credit Hours.
Prerequisite: Acceptance into the Cooperative Education in Engineering Program. Designed for students participating in Cooperative Education in Engineering Program. Problems related to students’ work assignments during their work for co-op employers. No more than 3 semester credit hours of Engineering Co-op may apply to a bachelor’s degree. To apply 3 semester credit hours of Engineering Co-op as a technical elective toward a degree in engineering, a student must petition and get approval of a faculty supervisor prior to co-op activities. (Formerly EGR 3301.) Course Fees: LRE1 $20; STSE $30.

EGR 3323. Applied Engineering Analysis II. (3-1) 3 Credit Hours.

EGR 3713. Engineering Economic Analysis. (3-0) 3 Credit Hours.
Prerequisites: ECO 2013 or ECO 2023, and MAT 1224. Time-value of money concepts; techniques for economic evaluation of engineering alternatives; depreciation and taxes; inflation and market rates; contracting practices; funding public projects and related public policy issues. Generally offered: Fall, Spring. Course Fees: LRE1 $20; STSE $30.

EGR 4953. Special Studies in Engineering. (3-0) 3 Credit Hours.
Prerequisite: Consent of instructor. An organized course offering the opportunity for specialized study not normally or not often available as part of the regular course offerings. Special Studies may be repeated for credit when topics vary, but not more than 6 semester credit hours, regardless of discipline, will apply to a bachelor’s degree. Course Fees: LRE1 $20; STSE $30.

EGR 4993. Honors Research. (0-0) 3 Credit Hours.
Prerequisite: Enrollment limited to candidates for college honors during their last two semesters; approval by the College Honors Committee. Supervised research and preparation of an honors thesis. May be repeated once with approval. Course Fees: LRE1 $20; STSE $30.