DEPARTMENT OF MECHANICAL ENGINEERING

The Department of Mechanical Engineering offers a Bachelor of Science degree in Mechanical Engineering (ME). The program is currently accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org (http://www.abet.org/). Individuals enrolling in this degree program are given the opportunity to develop a strong background in Engineering Science and to learn the analysis, design, and synthesis tools necessary to contribute in traditional and emerging areas of technology.

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

Because of the broad engineering training in this program, graduates may find employment in many industries, including companies or government agencies associated with aerospace, automotive, energy, petroleum, manufacturing, biomedical engineering, and research.

Direct Admission Criteria

Applicants entering UTSA as Freshmen or Freshmen Transfers (fewer than 12 transferable semester credit hours) will be directly admitted to the ME program if they:

- meet all UTSA undergraduate admission requirements,
- qualify for enrollment in MAT 1213 Calculus I, or a higher level mathematics course, and
  - are ranked in the top 10 percent of their high school class (no minimum SAT or ACT scores required), or
  - are ranked below the top 10 percent of their high school class and have a minimum 1200 SAT or 25 ACT score.

Applicants with SAT scores below 1200 or ACT scores below 25 may undergo admission by committee review.

Transfer requirements for direct admission to the ME program for students who have earned 12 or more transferable semester credit hours:

- meet all UTSA undergraduate transfer admission requirements, and
- have completed MAT 1213 Calculus I and WRC 1013 Freshman Composition I, or the equivalents, with grades of “C-” or better, and
- meet grade point average requirements:
  - applicants with a transfer grade point average of 3.00 or higher may be granted direct admission to the major, or
  - applicants with a transfer grade point average below 3.00 may be granted admission to the College by committee review.

Applicants who do not meet Mechanical Engineering admission requirements will be admitted to the Engineering, Math, and Sciences Studies major in the University College. Students have three semesters to complete Calculus I with a grade of “C-” or better and meet the ME Transfer 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 any 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.

Laptop Program

The laptop program requires that students entering Klesse College programs have their own laptop (notebook) computers and required software. The computer should be upgradeable in order to be of productive use for the duration of the academic program. The laptop specifications may vary per academic program. For further and specific information concerning laptop requirements for each program, please see the Klesse College hardware recommendations website (https://klesse.utsa.edu/student/computer-requirements.html).

Bachelor of Science Degree in Mechanical Engineering

The Bachelor of Science degree in Mechanical Engineering offers students the opportunity to prepare for careers in traditional, new, and emerging technologies related to the practice of Mechanical Engineering, which is a versatile and broadly-based engineering discipline. Mathematics and basic sciences, such as physics and chemistry, form the foundation of mechanical engineering, which requires an understanding of diverse subject areas, such as solid and fluid mechanics, thermal sciences, mechanical design, structures, material selection, manufacturing processes and systems, mechanical systems and control, and instrumentation.

The Mechanical Engineering curriculum provides education and basic engineering training through the required coursework. Students may develop increased specialization and depth through the selection of technical elective courses. Development of open-ended, problem-solving skills is a part of many mechanical engineering courses. Design projects with formal report writing are included in many courses. In addition, a substantial portion of technical elective courses is devoted to the design of systems and components. A capstone design sequence at the senior level provides an opportunity to apply and integrate the knowledge gained throughout the curriculum to the development of an instructor-approved project.

The laboratory requirements are designed to provide hands-on experience in basic measurement and instrumentation equipment and the application of classroom theory. Students may receive additional hands-on experiences by selecting technical elective courses with laboratory components.

Opportunities exist for students to participate in research and design projects. All students are eligible to participate in undergraduate research, through the independent study courses. Students also have an opportunity to participate in an approved co-op program and may receive up to 3 semester credit hours for their experience.

Program Educational Objectives

The Mechanical Engineering Program prepares students to attain the following program educational objectives a few years after graduation:

1. Have engineering or other careers in industry, government, and/or will pursue advanced graduate or professional degrees.
Department of Mechanical Engineering

2. Apply their engineering knowledge, critical thinking, creativity, and problem solving skills in professional engineering practice or in non-engineering fields.
3. Continue to advance their knowledge, communication, and leadership skills through graduate education, professional development courses, self-directed study, and/or on-the-job training and experience.
4. Apply their understanding of societal, environmental, and ethical issues to their professional activities.

Student Outcomes
Graduates of the UTSA Mechanical Engineering Program will demonstrate the following student outcomes. Attainment of these outcomes prepares graduates to enter the professional practice of engineering.

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

The minimum number of semester credit hours required for this degree is 128, at least 39 of which must be at the upper-division level. All candidates for this degree must fulfill the Core Curriculum requirements, the General Engineering requirements, and the degree requirements, listed below. A minimum grade of "C-" or better is required for all mathematics, science, Engineering (EGR), and Mechanical Engineering (ME) courses in the curriculum.

Core Curriculum Requirements (42 semester credit hours)
Students seeking the Bachelor of Science degree in Mechanical Engineering must fulfill the University Core Curriculum requirements in the same manner as other students. The courses listed below satisfy both major requirements and Core Curriculum requirements; however, if these courses are taken to satisfy both requirements, then students may need to take additional courses in order to meet the minimum number of semester credit hours required for the degree.

MAT 1213 may be used to satisfy the core requirement in Mathematics, as well as one of the General Engineering requirements. PHY 1943 and PHY 1963 may be used to satisfy the core requirement in Life and Physical Sciences, as well as two of the General Engineering requirements. EGR 1403 may be used to satisfy the core requirement in the Component Area Option. ECO 2023 may be used to satisfy the core requirement in the Social and Behavioral Sciences.

Core Curriculum Component Area Requirements (http://catalog.utsa.edu/undergraduate/bachelorsdegeregulations/degerequirements/corecurriculumcomponentarearequirements/)

<table>
<thead>
<tr>
<th>First Year Experience Requirement</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication</td>
<td>6</td>
</tr>
<tr>
<td>Mathematics</td>
<td>3</td>
</tr>
<tr>
<td>Life and Physical Sciences</td>
<td>6</td>
</tr>
<tr>
<td>Language, Philosophy and Culture</td>
<td>3</td>
</tr>
<tr>
<td>Creative Arts</td>
<td>3</td>
</tr>
<tr>
<td>American History</td>
<td>6</td>
</tr>
<tr>
<td>Government-Political Science</td>
<td>6</td>
</tr>
<tr>
<td>Social and Behavioral Sciences</td>
<td>3</td>
</tr>
<tr>
<td>Component Area Option</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Credit Hours 42

General Engineering Requirements
Students seeking the Bachelor of Science degree in Mechanical Engineering must complete the following 22 semester credit hours:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHE 1103</td>
<td>General Chemistry I</td>
<td>3</td>
</tr>
<tr>
<td>EGR 2302</td>
<td>Linear Algebra for Engineers</td>
<td>2</td>
</tr>
<tr>
<td>EGR 3423</td>
<td>Differential Equations for Engineers</td>
<td>3</td>
</tr>
<tr>
<td>MAT 1213</td>
<td>Calculus I</td>
<td>3</td>
</tr>
<tr>
<td>MAT 1223</td>
<td>Calculus II</td>
<td>3</td>
</tr>
<tr>
<td>or EGR 1333</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>Physics for Scientists and Engineers I Laboratory</td>
<td></td>
</tr>
<tr>
<td>PHY 1963</td>
<td>Physics for Scientists and Engineers II</td>
<td>4</td>
</tr>
<tr>
<td>&amp; PHY 1971</td>
<td>Physics for Scientists and Engineers II Laboratory</td>
<td></td>
</tr>
</tbody>
</table>

Total Credit Hours 22

Gateway Courses
Students pursuing the Bachelor of Science degree in Mechanical Engineering must successfully complete each of the following Gateway Courses with a grade of "C-" or better in no more than two attempts. A student who is unable to successfully complete these courses within two attempts, including dropping a course with a grade of "W" or taking an equivalent course at another institution, will be required to change his or her major.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>EGR 2103</td>
<td>Statics</td>
<td>3</td>
</tr>
<tr>
<td>EGR 2513</td>
<td>Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>EGR 3423</td>
<td>Differential Equations for Engineers</td>
<td>3</td>
</tr>
<tr>
<td>MAT 1213</td>
<td>Calculus I</td>
<td>3</td>
</tr>
</tbody>
</table>

Degree Requirements
Students seeking the Bachelor of Science degree in Mechanical Engineering must complete the following semester credit hours, as
well as the Core Curriculum requirements and General Engineering requirements:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Required foundation and general mechanical engineering courses:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ECO 2023</td>
<td>Introductory Microeconomics</td>
<td>3</td>
</tr>
<tr>
<td>EE 2213</td>
<td>Electric Circuits and Electronics</td>
<td>3</td>
</tr>
<tr>
<td>EGR 2103</td>
<td>Statics</td>
<td>3</td>
</tr>
<tr>
<td>EGR 2313</td>
<td>Multivariable Calculus and Series for Engineers</td>
<td>3</td>
</tr>
<tr>
<td>or MAT 2213</td>
<td>Calculus III</td>
<td></td>
</tr>
<tr>
<td>EGR 2513</td>
<td>Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>EGR 3713</td>
<td>Engineering Economic Analysis</td>
<td>3</td>
</tr>
<tr>
<td>ME 1403</td>
<td>Engineering Practice and Graphics</td>
<td>3</td>
</tr>
<tr>
<td>ME 3113</td>
<td>Measurements and Instrumentation</td>
<td>3</td>
</tr>
<tr>
<td>ME 3173</td>
<td>Numerical Methods</td>
<td>3</td>
</tr>
<tr>
<td>ME 3241</td>
<td>Materials Engineering Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>ME 3243</td>
<td>Manufacturing Engineering</td>
<td>3</td>
</tr>
<tr>
<td>ME 3263</td>
<td>Mechanical Vibration</td>
<td>3</td>
</tr>
<tr>
<td>ME 3293</td>
<td>Thermodynamics I</td>
<td>3</td>
</tr>
<tr>
<td>ME 3541</td>
<td>Dynamics and Controls Laboratory</td>
<td>3</td>
</tr>
<tr>
<td>ME 3543</td>
<td>Dynamic Systems and Control</td>
<td>3</td>
</tr>
<tr>
<td>ME 3663</td>
<td>Fluid Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>ME 3813</td>
<td>Mechanics of Solids</td>
<td>3</td>
</tr>
<tr>
<td>ME 3823</td>
<td>Machine Element Design</td>
<td>3</td>
</tr>
<tr>
<td>ME 4293</td>
<td>Thermodynamics II</td>
<td>3</td>
</tr>
<tr>
<td>ME 4312</td>
<td>Thermal and Fluids Laboratory</td>
<td>2</td>
</tr>
<tr>
<td>ME 4313</td>
<td>Heat Transfer</td>
<td>3</td>
</tr>
<tr>
<td>ME 4801</td>
<td>Manufacturing Practices Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>ME 4812</td>
<td>Senior Design I</td>
<td>2</td>
</tr>
<tr>
<td>ME 4813</td>
<td>Senior Design II</td>
<td>3</td>
</tr>
<tr>
<td>B. Mechanical Engineering elective courses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Select 9 semester credit hours of Mechanical Engineering elective courses. Students are encouraged to choose courses from a specific group listed below. Students may also select courses to partially satisfy the requirements of a certificate in one of the following areas: 1) Aerospace Engineering; 2) Heating, Ventilation and Air Conditioning; 3) Industrial and Manufacturing Engineering; or 4) Oil/Gas. For detailed requirements, see the Certificates section of the Mechanical Engineering program.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Aerospace**
- ME 3323 Mechanical Vibration
- ME 4123 Aerodynamics
- ME 4143 Propulsion
- ME 4153 Astrodynamics
- ME 4163 Aircraft Performance
- ME 4183 Compressible Flow
- ME 4603 Finite Element Analysis
- ME 4723 Reliability and Quality Control in Engineering Design

**Design and Control of Mechanical Systems**
- ME 3323 Mechanical Vibration
- ME 3513 Mechanism Design

**Energy, Thermal and Fluid Systems**
- ME 4183 Compressible Flow
- ME 4323 Thermal Systems Design
- ME 4343 Heating, Air Conditioning, and Refrigeration Design
- ME 4593 Alternative Energy Sources
- ME 4613 Power Plant System Design
- ME 4623 Internal Combustion Engines

**Heating, Ventilation and Air-Conditioning**
- ME 4323 Thermal Systems Design
- ME 4343 Heating, Air Conditioning, and Refrigeration Design
- ME 4593 Alternative Energy Sources
- ME 4613 Power Plant System Design
- ME 4953 Special Studies in Mechanical Engineering (SS in HVAC Controls)
- ME 4953 Special Studies in Mechanical Engineering (SS in Refrigeration)
- ME 4953 Special Studies in Mechanical Engineering (SS in Indoor Air Quality)

**Industrial and Manufacturing**
- ME 3253 Medical Device Design and Commercialization
- ME 3273 Operations Research
- ME 4273 Systems Modeling and Analysis
- ME 4503 Lean Manufacturing and Enterprise Engineering
- ME 4543 Mechatronics
- ME 4563 Computer Integrated Manufacturing
- ME 4573 Facilities Planning and Design
- ME 4583 Enterprise Process Engineering
- ME 4723 Reliability and Quality Control in Engineering Design
- ME 4773 Robotics

**Mechanics and Materials**
- ME 4243 Intermediate Materials Engineering
- ME 4603 Finite Element Analysis
- ME 4963 Mechanical Engineering Applications to Biomedical Systems

**Oil and Gas**
- ME 3323 Mechanical Vibration
- ME 4323 Thermal Systems Design
- ME 4373 Separation Processes
- ME 4593 Alternative Energy Sources
- ME 4603 Finite Element Analysis
- ME 4643 Pressure Vessel and Piping Design
- ME 4653 Oil and Gas Engineering and Reservoir Geomechanics
- ME 4683 Corrosion Engineering

**Additional engineering elective courses**
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>EGR 3303</td>
<td>Engineering Co-op</td>
<td>1</td>
</tr>
<tr>
<td>EGR 4993</td>
<td>Honors Research</td>
<td>1</td>
</tr>
<tr>
<td>ME 3183</td>
<td>Python: Big Data in Engineering and Environmental Systems</td>
<td>3</td>
</tr>
<tr>
<td>ME 4173</td>
<td>High Performance Computing</td>
<td>3</td>
</tr>
<tr>
<td>ME 4913</td>
<td>Independent Study</td>
<td>1</td>
</tr>
<tr>
<td>ME 4953</td>
<td>Special Studies in Mechanical Engineering</td>
<td>3</td>
</tr>
</tbody>
</table>

Graduate Courses in Mechanical Engineering

C. 3 semester credit hours of approved mathematics or basic science elective courses, selected from the following list:

- BIO 1233, Contemporary Biology I
- BIO 1243, Contemporary Biology II
- BIO 1203, Biosciences I for Science Majors
- BIO 3483, Biology of Human Reproduction
- CHE 1113, General Chemistry II
- CHE 2603, Organic Chemistry I
- ES 2013, Introduction to Environmental Science I
- GEO 1123, Life Through Time
- MAT 3013, Foundations of Mathematics
- MAT 3103, Data Analysis and Interpretation
- PHY 2103, Modern Physics
- PHY 3203, Classical Mechanics I
- STA 2303, Applied Probability and Statistics for Engineers
- STA 3003, Statistical Methods and Applications

**Total Credit Hours**: 76

1. With prior approval, these courses may be used as a technical elective.
2. Graduate courses require approval. Forms are available from your academic advisor.

### B.S. in Mechanical Engineering – Recommended Four-Year Academic Plan

#### First Year

**Fall**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIS 1243</td>
<td>AIS: Engineering, Mathematics, and Sciences</td>
<td>3</td>
</tr>
<tr>
<td>CHE 1103</td>
<td>General Chemistry I</td>
<td>3</td>
</tr>
<tr>
<td>MAT 1213</td>
<td>Calculus I (core and major)</td>
<td>3</td>
</tr>
<tr>
<td>ME 1403</td>
<td>Engineering Practice and Graphics</td>
<td>3</td>
</tr>
<tr>
<td>WRC 1013</td>
<td>Freshman Composition I (core)</td>
<td>3</td>
</tr>
</tbody>
</table>

**Credit Hours**: 15

**Spring**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
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</thead>
<tbody>
<tr>
<td>MAT 1223</td>
<td>Calculus II</td>
<td>3</td>
</tr>
<tr>
<td>PHY 1943</td>
<td>Physics for Scientists and Engineers I (core and major)</td>
<td>3</td>
</tr>
<tr>
<td>PHY 1951</td>
<td>Physics for Scientists and Engineers I Laboratory</td>
<td>3</td>
</tr>
<tr>
<td>POL 1013</td>
<td>Introduction to American Politics (core)</td>
<td>3</td>
</tr>
<tr>
<td>WRC 1023</td>
<td>Freshman Composition II (core)</td>
<td>3</td>
</tr>
<tr>
<td>American History (core)</td>
<td></td>
<td>3</td>
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</table>

**Credit Hours**: 16

### Second Year

#### Fall

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>EGR 2103</td>
<td>Statics</td>
<td>3</td>
</tr>
<tr>
<td>EGR 2302</td>
<td>Linear Algebra for Engineers</td>
<td>2</td>
</tr>
<tr>
<td>EGR 2313</td>
<td>Multivariable Calculus and Series for Engineers</td>
<td>3</td>
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<td>PHY 1963</td>
<td>Physics for Scientists and Engineers II (core and major)</td>
<td>3</td>
</tr>
<tr>
<td>PHY 1971</td>
<td>Physics for Scientists and Engineers II Laboratory</td>
<td>1</td>
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<tr>
<td>EGR 1403</td>
<td>Technical Communication (or other core option)</td>
<td>3</td>
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</table>

**Math/Science Elective**: 3

#### Spring

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course 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>EGR 2513</td>
<td>Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>EGR 3423</td>
<td>Differential Equations for Engineers</td>
<td>3</td>
</tr>
<tr>
<td>ME 3241</td>
<td>Materials Engineering Laboratory</td>
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</tr>
<tr>
<td>ME 3243</td>
<td>Materials Engineering</td>
<td>3</td>
</tr>
<tr>
<td>ME 3293</td>
<td>Thermodynamics I</td>
<td>3</td>
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</table>

**Credit Hours**: 18

### Third Year

#### Fall

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME 3113</td>
<td>Measurements and Instrumentation</td>
<td>3</td>
</tr>
<tr>
<td>ME 3173</td>
<td>Numerical Methods</td>
<td>3</td>
</tr>
<tr>
<td>ME 3663</td>
<td>Fluid Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>ME 3813</td>
<td>Mechanics of Solids</td>
<td>3</td>
</tr>
<tr>
<td>ME 4293</td>
<td>Thermodynamics II</td>
<td>3</td>
</tr>
<tr>
<td>Language, Philosophy &amp; Culture (core)</td>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>

**Credit Hours**: 18

#### Spring

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME 3263</td>
<td>Manufacturing Engineering</td>
<td>3</td>
</tr>
<tr>
<td>ME 3541</td>
<td>Dynamics and Controls Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>ME 3543</td>
<td>Dynamic Systems and Control</td>
<td>3</td>
</tr>
<tr>
<td>ME 3823</td>
<td>Machine Element Design</td>
<td>3</td>
</tr>
<tr>
<td>ME 4313</td>
<td>Heat Transfer</td>
<td>3</td>
</tr>
<tr>
<td>ECO 2023</td>
<td>Introductory Microeconomics</td>
<td>3</td>
</tr>
</tbody>
</table>

**Credit Hours**: 16

### Fourth Year

#### Fall

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>EGR 3713</td>
<td>Engineering Economic Analysis</td>
<td>3</td>
</tr>
<tr>
<td>ME 4312</td>
<td>Thermal and Fluids Laboratory</td>
<td>2</td>
</tr>
<tr>
<td>ME 4801</td>
<td>Manufacturing Practices Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>ME 4812</td>
<td>Senior Design I</td>
<td>2</td>
</tr>
<tr>
<td>POL 1133 or POL 1213</td>
<td>Texas Politics and Society (core) or Civil Rights in Texas and America</td>
<td>3</td>
</tr>
<tr>
<td>ME Technical elective</td>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>

**Credit Hours**: 14
Certificate in Aerospace Engineering

The Certificate in Aerospace Engineering is designed to prepare degree-seeking students or degree holders in mechanical engineering or related fields with the fundamental engineering knowledge necessary for successful careers in the aerospace industry. It certifies to employers that students awarded the certificate have completed coursework essential to success in entry-level positions in aerospace.

Eligibility requirements:

• Meet the prerequisite courses for the certificate program (refer to course descriptions in the UTSA Undergraduate Catalog)

Students pursuing an Aerospace Engineering certificate must complete 15 semester credit hours as follows:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Required courses:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ME 3663</td>
<td>Fluid Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>B. ME electives. A minimum of three courses (9 semester credit hours) selected from the following list:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ME 4123</td>
<td>Aerodynamics</td>
<td>3</td>
</tr>
<tr>
<td>ME 4143</td>
<td>Propulsion</td>
<td>3</td>
</tr>
<tr>
<td>ME 4153</td>
<td>Astrodynamics</td>
<td>3</td>
</tr>
<tr>
<td>ME 4163</td>
<td>Aircraft Performance</td>
<td>3</td>
</tr>
<tr>
<td>ME 4183</td>
<td>Compressible Flow</td>
<td>3</td>
</tr>
<tr>
<td>C. Additional electives. If only three courses are selected from list B, then an additional 3 semester credit hours must be completed from the following list:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ME 3323</td>
<td>Mechanical Vibration</td>
<td>3</td>
</tr>
<tr>
<td>ME 4603</td>
<td>Finite Element Analysis</td>
<td>3</td>
</tr>
<tr>
<td>ME 4683</td>
<td>Corrosion Engineering</td>
<td>3</td>
</tr>
<tr>
<td>ME 4723</td>
<td>Reliability and Quality Control in Engineering Design</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Credit Hours 15

Certificate in Heating, Ventilation and Air-Conditioning

The Certificate in Heating, Ventilation and Air-Conditioning (HVAC) is designed to prepare degree-seeking students or degree holders in mechanical engineering or related fields with the fundamental engineering knowledge necessary for successful careers in the HVAC design, manufacture, selection, and/or installation of mechanical equipment which controls the built environment. It certifies to employers that students awarded the certificate have completed coursework essential to success in entry-level positions in HVAC related fields.

Eligibility requirements:

• Meet the prerequisite courses for the certificate program (refer to course descriptions in the UTSA Undergraduate Catalog)

Students pursuing a HVAC certificate must complete 15 semester credit hours as follows:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Required courses:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ME 4313</td>
<td>Heat Transfer</td>
<td>3</td>
</tr>
<tr>
<td>B. ME electives. A minimum of three courses (9 semester credit hours) selected from the following list:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ME 4323</td>
<td>Thermal Systems Design</td>
<td>9-12</td>
</tr>
<tr>
<td>ME 4343</td>
<td>Heating, Air Conditioning, and Refrigeration Design</td>
<td>9-12</td>
</tr>
<tr>
<td>ME 4613</td>
<td>Power Plant System Design</td>
<td>9-12</td>
</tr>
<tr>
<td>ME 4953</td>
<td>Special Studies in Mechanical Engineering (SS in HVAC Controls)</td>
<td>9-12</td>
</tr>
<tr>
<td>ME 4953</td>
<td>Special Studies in Mechanical Engineering (SS in Refrigeration)</td>
<td>9-12</td>
</tr>
<tr>
<td>ME 4953</td>
<td>Special Studies in Mechanical Engineering (SS in Indoor Air Quality)</td>
<td>9-12</td>
</tr>
<tr>
<td>C. Additional electives. If only three courses are selected from list B, then an additional 3 semester credit hours must be completed.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ME 4593</td>
<td>Alternative Energy Sources</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Credit Hours 15

Certificate in Industrial and Manufacturing Engineering

The Certificate in Industrial and Manufacturing Engineering is designed to prepare degree-seeking students or degree holders in mechanical engineering or related fields with the fundamental engineering knowledge necessary for successful careers in the manufacturing industry. It certifies to employers that students awarded the certificate have completed coursework essential to success in entry-level engineering positions in manufacturing.

Eligibility requirements:

• Meet the prerequisite courses for the certificate program (refer to course descriptions in the UTSA Undergraduate Catalog)

Students pursuing an Industrial and Manufacturing Engineering certificate must complete 15 semester credit hours as follows:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Required courses:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ME 3263</td>
<td>Manufacturing Engineering</td>
<td>3</td>
</tr>
<tr>
<td>B. ME electives. A minimum of three courses (9 semester credit hours) selected from the following list:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ME 3253</td>
<td>Medical Device Design and Commercialization</td>
<td>9-12</td>
</tr>
</tbody>
</table>
To earn any certificate in the mechanical engineering program, students must satisfy the following requirements:

1. Complete all the requirements of the certificate program.
2. Receive a grade of "C-" or better in each course used to satisfy the requirements of the certificate program.
3. Achieve at least a 2.5 grade point average (on a 4.0 scale) in all courses used to satisfy the requirements of the certificate program.

Undergraduates who are currently enrolled in the baccalaureate degree program in mechanical engineering or enrolled as non-degree-seeking students and who wish to earn an undergraduate certificate offered by the mechanical engineering program are eligible to enroll in the certificate program, provided they satisfy the course prerequisite requirements.

Students not currently admitted to UTSA who wish to earn an undergraduate certificate offered by the mechanical engineering program will be required to apply for admission to UTSA as special (non-degree-seeking) students at the undergraduate level.

Students who are pursuing a certificate as non-degree-seeking students will not be eligible for financial aid or Veterans Administration educational benefits.

Graduate students may enroll in the undergraduate certificate programs, provided they meet the requirements for enrollment in the certificate program.

During the last semester in the certificate program, students must submit an application for the Undergraduate Certificate to the Office of the Registrar.

### Mechanical Engineering (ME) Courses

#### ME 1403. Engineering Practice and Graphics. (2-3) 3 Credit Hours. (TCCN = ENGR 1304)
Prerequisites: MAT 1093 and completion of or concurrent enrollment in WRC 1013. Introduction to engineering practice and engineering graphics: geometric constructions, multi-view drawing, dimensioning, sections, pictorials and auxiliary views. Computer-aided design, generation of mechanical drawings, and design projects. (Formerly ME 1402. Credit cannot be earned for both ME 1402 and ME 1403.) Course Fees: LRE1 $25; STSE $30.

#### ME 3113. Measurements and Instrumentation. (2-3) 3 Credit Hours.

#### ME 3173. Numerical Methods. (2-3) 3 Credit Hours.
Prerequisite: EGR 3423. Introduction to numerical algorithms to solve science and engineering problems. Construction and derivation of numerical algorithm as well as application limits. Various numerical approaches in finding roots of linear and non-linear functions, regression analysis, interpolation, curve fitting procedures, differentiation, integration, solutions of system of linear algebraic equations, solutions of ordinary differential equations and boundary value problems. (Formerly ME 2173. Credit cannot be earned for both ME 3173 and ME 2173.) Generally offered: Fall, Spring, Summer. Course Fees: LRE1 $25; STSE $30; DL01 $75.
ME 3183. Python: Big Data in Engineering and Environmental Systems. (3-0) 3 Credit Hours.
Prerequisite: ME 3173 (or ME 2173 in previous catalogs), or equivalent. Introduction to Python as a programming language and to several modules of Python specific to scientific computing. Understanding physical principles of engineering systems from data using Python platform. The course introduces scientific data analysis including statistical analysis of stochastic processes and numerical methods for big data. Differential Tuition: $165.

ME 3241. Materials Engineering Laboratory. (0-3) 1 Credit Hour.
Prerequisite: Concurrent enrollment in or completion of ME 3243. Investigation of the mechanical properties of engineering materials, with emphasis on metals, sample preparation, and metallography. (Formerly ME 3244. Credit cannot be earned for both ME 3244 and ME 3241.) Differential Tuition: $55. Course Fee: L001 $30.

ME 3243. Materials Engineering. (3-0) 3 Credit Hours.
Prerequisites: CHE 1103, EGR 2103, and concurrent enrollment in or completion of ME 3241. Fundamentals in atomic structure, microstructures, properties, and mechanical behavior of engineering materials, such as metals, polymers, and ceramics. (Formerly ME 3244. Credit cannot be earned for both ME 3244 or ME 3243 and ME 3241. Prior completion of ME 3244 can be substituted for ME 3243 and ME 3241.) Generally offered: Fall, Spring. Differential Tuition: $165. Course fee: DL01 $75.

ME 3253. Medical Device Design and Commercialization. (3-0) 3 Credit Hours.
Prerequisite: ME 3173 (or ME 2173 in previous catalogs), or equivalent. Introduction to medical device development, clinical perspective in approaching design, medical design process, relevant regulatory policies, manufacturing concerns, military medicine, dentistry, medtech entrepreneurship, and medical robotics. The course materials and experiential learning will enable students to examine how the interdependent roles of medical care, engineering, technology, and policy impact device design in contemporary medicine. Differential Tuition: $165.

ME 3263. Manufacturing Engineering. (3-0) 3 Credit Hours.
Prerequisites: EGR 2513, ME 3241, and ME 3243 (or ME 3244 in previous catalogs). Manufacturing processes, quality assurance, statistical methods, economic analysis, planning, and communication. (Formerly titled "Materials Processing.") Generally offered: Fall, Spring, Summer. Differential Tuition: $165.

ME 3273. Operations Research. (3-0) 3 Credit Hours.
Prerequisite: ME 3173 (or ME 2173 in previous catalogs), or equivalent. Introduction to fundamental optimization models and solution methods, including linear programs, the simplex method, duality theory, sensitivity analysis, integer programs, and network flows. Focus on formulating and solving practical operations research problems and the use of optimization software. Differential Tuition: $165.

ME 3293. Thermodynamics I. (3-0) 3 Credit Hours.
Prerequisite: EGR 2103 and MAT 1223 (or MAT 1224 in previous catalogs). Heat, work, equations of state, thermodynamics systems, control volume, first and second laws of thermodynamics, applications of the laws of thermodynamics, reversible and irreversible processes, and introduction to basic thermodynamic cycles. Generally offered: Fall, Spring, Summer. Differential Tuition: $165. Course Fee: DL01 $75.

ME 3323. Mechanical Vibration. (3-0) 3 Credit Hours.

ME 3513. Mechanism Design. (3-0) 3 Credit Hours.
Prerequisites: EGR 2513 and ME 1403. Introduction to mechanisms, graphical and linear analytical methods for kinematic synthesis of mechanisms; design of cam follower; gearing fundamentals, ordinary and planetary gear trains; and computer-aided design projects. Differential Tuition: $165.

ME 3541. Dynamics and Controls Laboratory. (0-3) 1 Credit Hour.
Prerequisites: ME 3113 and concurrent enrollment in or completion of ME 3543. Investigation of the dynamics and control of physical systems. (Formerly ME 4733. Credit cannot be earned for both ME 4733 and ME 3541.) Differential Tuition: $55.

ME 3543. Dynamic Systems and Control. (3-0) 3 Credit Hours.
Prerequisite: EGR 2513, EGR 3423, and concurrent enrollment in or completion of ME 3543. Introduction to modeling and control of dynamic physical systems, analysis and design of control systems for mechanical, electrical, manufacturing, fluid, and thermal systems. (Formerly ME 4522 and ME 4523. Credit cannot be earned for more than one of the following: ME 3543, ME 4522, or ME 4523.) Generally offered: Fall, Spring, Summer. Differential Tuition: $165. Course Fee: DL01 $75.

ME 3663. Fluid Mechanics. (3-0) 3 Credit Hours.
Prerequisite: EGR 2513, EGR 3423, and completion of or concurrent enrollment in ME 3293. Fluid properties, fluid statics, integral and differential analysis of fluid flow, viscous laminar and turbulent flow in conduits, dimensional analysis, boundary layer concepts, drag and lift. Generally offered: Fall, Spring, Summer. Differential Tuition: $165. Course Fee: DL01 $75.

ME 3813. Mechanics of Solids. (3-0) 3 Credit Hours.
Prerequisite: EGR 2103 and MAT 1223 (or MAT 1224 in previous catalogs). Internal forces and deformations in solids, stress, strain and their relations, torsion, stresses and deflections in beams, and elastic behavior of columns. Generally offered: Fall, Spring, Summer. Differential Tuition: $165. Course Fee: DL01 $75.

ME 3823. Machine Element Design. (3-0) 3 Credit Hours.
Prerequisites: ME 1403, ME 3241, ME 3243 (or ME 3244 in previous catalogs), and ME 3813. Introduction to design of machine elements, materials selection, static and fatigue failures, shafts, fasteners, springs, gears, bearings and design projects. (Formerly ME 4423. Credit cannot be earned for both ME 3823 and ME 4423.) Generally offered: Fall, Spring, Summer. Differential Tuition: $165. Course Fee: DL01 $75.

ME 4123. Aerodynamics. (3-0) 3 Credit Hours.
Prerequisite: ME 3293 and ME 3663. Fundamental principles of Aerodynamics, background review; inviscid incompressible flow, flow over airfoils and finite wings, Panel method, compressible flow and shockwaves including supersonic flow, oblique shock and expansion waves, subsonic compressible flow over airfoils, linearized flows in aerodynamics, concepts in viscous flow, and Computational methods in Aerodynamics. Differential Tuition: $165.
ME 4143. Propulsion. (3-0) 3 Credit Hours.
Prerequisite: ME 3293 and ME 3663. Application of thermodynamics and fluid mechanics to the analysis of problems related to the propulsion of aerospace vehicles. Development of control volume analysis techniques for compressible flow problems, with applications in the design and analysis of rocket nozzles and state-of-the-art propulsion systems like ramjets, scramjets, and detonation cycle systems. Differential Tuition: $165.

ME 4153. Astrodynamics. (3-0) 3 Credit Hours.
Prerequisite: ME 3543. Two-body orbital mechanics, introduction to reference frames, orbit elements representation, the solar system as a set of orbiting bodies, orbit determination, orbital maneuvers, interplanetary trajectories, and common orbital perturbations. Differential Tuition: $165.

ME 4163. Aircraft Performance. (3-0) 3 Credit Hours.
Prerequisite: ME 3293 and ME 3663. Study of aircraft performance using the governing equations of fluid dynamics, atmospheric properties, and the concepts of lift and drag. Analysis of level flight performance, rates of climb, service and absolute ceilings, range, take-off and landing, and turn performance. Study of longitudinal and lateral stability applied to aircraft. Differential Tuition: $165.

ME 4173. High Performance Computing. (3-0) 3 Credit Hours.
Prerequisite: ME 3173 (or ME 2173 in previous catalogs), or equivalent. Introduction to UNIX (login, shell scripts, editors, file permissions), visualization (software tools, data formats), Parallel programming (numerical libraries, Message Passing Interface, Trilinos, GPGPU programming). Differential Tuition: $165.

ME 4183. Compressible Flow. (3-0) 3 Credit Hours.
Prerequisites: ME 3293 and ME 3663. Analysis of one-dimensional steady compressible flow, isentropic flow, compressible boundary layers, transition from subsonic to supersonic flow, Fanno and Rayleigh flow, supersonic nozzle design, normal and oblique shock waves, and expansion fans. (Formerly EGR 4183. Credit cannot be earned for both ME 4183 and EGR 4183.) Differential Tuition: $165.

ME 4243. Intermediate Materials Engineering. (3-0) 3 Credit Hours.
Prerequisites: ME 3241, ME 3243 (or ME 3244 in previous catalogs), and ME 3813. Selected topics in fabrication and processing of materials; macroscopic and microscopic aspects of the mechanical behavior of metals, ceramics, polymers and composites; Failure mode analysis in materials; optimization of material selection in the design process. Differential Tuition: $165.

ME 4273. Systems Modeling and Analysis. (3-0) 3 Credit Hours.
Prerequisite: ME 3173 (or ME 2173 in previous catalogs), and ME 3113. Systems analysis approach to formulating and solving engineering problems. Topics include mathematical modeling, discrete event simulation, and decision analysis. Focus on applying systems modeling methods on practical industrial problems and the use of simulation software. Differential Tuition: $165.

ME 4293. Thermodynamics II. (3-0) 3 Credit Hours.
Prerequisite: ME 3293. Energy and (availability) analysis, reactive and nonreactive mixtures, moist air properties, psychometric systems and analysis, vapor and gas power cycles, refrigeration and heat-pump cycles, and thermodynamic relations. Generally offered: Fall, Spring. Differential Tuition: $165.

ME 4312. Thermal and Fluids Laboratory. (0-6) 2 Credit Hours.
Prerequisites: ME 3113, ME 4293, and concurrent enrollment in or completion of ME 4313. Investigation of thermal and fluid physical systems, and design of experiments. (Formerly ME 4733. Credit cannot be earned for both ME 4733 and ME 4312.) Differential Tuition: $110.

ME 4313. Heat Transfer. (3-0) 3 Credit Hours.
Prerequisite: EGR 3423, ME 3173 (or ME 2173 in previous catalogs), ME 3293, and ME 3663. Generalized potential distribution and gradients, and heat transfer, including transient and steady state conduction, forced and free convection, radiation, and heat exchanger analysis. Generally offered: Fall, Spring. Differential Tuition: $165.

ME 4323. Thermal Systems Design. (3-0) 3 Credit Hours.
Prerequisite: ME 4313. Application of thermodynamics, fluid mechanics, heat transfer, and computer methods to the design of thermal energy systems. Differential Tuition: $165.

ME 4343. Heating, Air Conditioning, and Refrigeration Design. (3-0) 3 Credit Hours.
Prerequisite: ME 4293. Moist air properties, human comfort, solar radiation, heating/cooling loads, design selection, operation of air conditioning equipment, and duct design. Differential Tuition: $165.

ME 4373. Separation Processes. (3-0) 3 Credit Hours.
Prerequisite: ME 4293. Rate- and equilibrium-controlled separation, mass transfer, phase equilibrium, distillation, and extraction. Differential Tuition: $165.

ME 4503. Lean Manufacturing and Enterprise Engineering. (3-0) 3 Credit Hours.
Prerequisite: ME 3263. Concepts and applications of Lean Systems applied to manufacturing and non-manufacturing environments. Topics include lean fundamentals and various tools and methodologies for transformation of companies and organizations into globally competitive enterprises. Team project on Value Streaming Mapping analysis of processes in real settings is required. Differential Tuition: $165.

ME 4543. Mechatronics. (2-3) 3 Credit Hours.
Prerequisite: ME 3113. Modeling and analysis of electrical (resistors, capacitors, inductors, diodes, transistors, operational amplifiers, combinational logic and sequential logic) and mechanical systems (spring mass damper), data acquisition and measurements, sensors, actuators, and micro-controller programming. Lab component with emphasis on building electrical circuits, data acquisition using LabVIEW, and integration of sensors, actuators, and micro-controller programming (Arduino) to create a mechatronics system. Generally offered: Fall, Spring. Differential Tuition: $165. Course Fees: L001 $30; DL01 $75.

ME 4553. Automotive Vehicle Dynamics. (3-0) 3 Credit Hours.
Prerequisite: EGR 2513 and EGR 3423. Dynamics and control of automotive systems, handling, tires, suspension, steering, and aerodynamic forces. Differential Tuition: $165.

ME 4563. Computer Integrated Manufacturing. (3-0) 3 Credit Hours.
Prerequisite: ME 3263. Fundamental concepts and models related to computer-aided design, computer-aided process planning, computer-aided manufacturing, production planning and scheduling, and manufacturing execution systems. Laboratory work includes computer-aided applications and programming of automated production equipment. Differential Tuition: $165.

ME 4573. Facilities Planning and Design. (3-0) 3 Credit Hours.
Prerequisite: ME 3263. Product, process, and schedule design, flow, space, and activity relationships, material handling, layout planning models and design algorithms, and warehouse operations. Differential Tuition: $165.
ME 4583. Enterprise Process Engineering. (3-0) 3 Credit Hours.
Prerequisite: ME 3263. Fundamental concepts, methodologies, and tools for the design, engineering and continuous improvement of enterprises. Topics include Six Sigma for process design and improvement, lean manufacturing fundamentals, value-stream mapping, performance evaluation, and other contemporary enterprise process engineering approaches. Generally offered: Fall. Differential Tuition: $165. Course fee: DL01 $75.

ME 4593. Alternative Energy Sources. (3-0) 3 Credit Hours.
Prerequisite: ME 3173 (or ME 2173 in previous catalogs), ME 3113, ME 3663, and ME 4293. Nuclear, geothermal, solar, biomass, wind, and hydrogen energy sources. Resources, production, utilization, economics, sustainability, and environmental considerations. (Formerly ME 3593. Credit cannot be earned for both ME 3593 and ME 4593.) Differential Tuition: $165.

ME 4603. Finite Element Analysis. (3-0) 3 Credit Hours.
Prerequisite: EGR 3423, ME 3173 (or ME 2173 in previous catalogs), and ME 3823. Finite element method fundamentals, advanced geometric modeling of mechanical components and systems, and finite element modeling of components. Differential Tuition: $165.

ME 4613. Power Plant System Design. (3-0) 3 Credit Hours.
Prerequisite: ME 4293. Application of thermodynamics and fluid mechanics to the design of vapor and gas-turbine power plant systems including boilers, condensers, turbines, pumps, compressors, and cooling towers. Differential Tuition: $165.

ME 4623. Internal Combustion Engines. (3-0) 3 Credit Hours.

ME 4643. Pressure Vessel and Piping Design. (3-0) 3 Credit Hours.
Prerequisites: ME 3663 and ME 3813, ASME Section XIII Boiler and Pressure Vessel code, inspection, maintenance, repair, and modification of pressure vessels. Piping design and construction. Differential Tuition: $165.

ME 4653. Oil and Gas Engineering and Reservoir Geomechanics. (3-0) 3 Credit Hours.
Prerequisites: ME 3663 and ME 3813. Introduction to the oil and gas industry. Measurement; deformation mechanisms in rock; rock fracture description and analysis; wellbore stresses and failure; wellbore stability analysis; fault stability analysis; depletion-induced reservoir deformation; and hydraulic fracturing. Differential Tuition: $165.

ME 4683. Corrosion Engineering. (3-0) 3 Credit Hours.
Prerequisites: ME 3241 and ME 3242 (or ME 3244 in previous catalogs). Principles of electrochemistry, fundamentals of the environmental degradation of materials, corrosion thermodynamics and kinetics, corrosion phenomenology, and corrosion control and prevention. Differential Tuition: $165. Course fee: DL01 $75.

ME 4723. Reliability and Quality Control in Engineering Design. (3-0) 3 Credit Hours.
Prerequisite: ME 3113. Introduction to statistical methods in reliability and probabilistic engineering design methodology, statistical quality control and inspection, life prediction and testing, and design optimization. Generally offered: Fall. Differential Tuition: $165. Course fee: DL01 $75.

ME 4773. Robotics. (3-0) 3 Credit Hours.
Prerequisite: EGR 2513; and ME 3173 (or ME 2173 in previous catalogs). Kinematics, dynamics, planning and control of mobile robots and manipulators. Special topics may include legged robots, soft robots, climbing robots, advanced control methods, image processing, computer vision, estimation. A LEGO-based laboratory with emphasis on prototyping robotic systems for practical applications. Differential Tuition: $165.

ME 4801. Manufacturing Practices Laboratory. (0-3) 1 Credit Hour.
Prerequisite: Concurrent enrollment in, or completion of, ME 3263. Use of measurement tools, saw, drill, mill, lathe, and welding. Differential Tuition: $55.

ME 4812. Senior Design I. (2-0) 2 Credit Hours.
Prerequisites: ME 3113, ME 3263, ME 3543, ME 3663, ME 3823, and ME 4293; completion of or concurrent enrollment in ME 4313, ME 4801, ME 4312, and EGR 3713 or ME 4543 required. Design project proposals, computer-aided synthesis, analysis, and modeling of an open-ended problem development and presentation of conceptual designs. Industrial cooperation encouraged. This course, as well as ME 4313, ME 4543, ME 4801, and ME 3541, must be completed with a grade of "C-" or better to serve as prerequisites for ME 4813. (Formerly ME 4811 and ME 4803. Credit cannot be earned for more than one of the following: ME 4812, ME 4803, or ME 4811.) Differential Tuition: $110. Course fee: DL01 $50.

ME 4813. Senior Design II. (2-3) 3 Credit Hours.
Prerequisites: ME 3541, ME 4312, ME 4313, ME 4801, ME 4812, and EGR 3713 or ME 4543. Development of a working design of an instructor-approved design project using computer-aided synthesis, analysis, modeling, and optimization methods. Industrial cooperation encouraged. Considerations of safety, reliability, environmental, and economic constraints, and ethical and social impacts. Generally offered: Fall, Spring. Differential Tuition: $165. Course Fees: L001 $30; DL01 $75.

ME 4911. Independent Study. (0-0) 1 Credit Hour.
Prerequisite: Permission in writing (form available) from the instructor, the Department Chair, and Dean of the College. Independent reading, research, discussion, and/or writing under the direction of a faculty member. May be repeated for credit, but not more than 6 semester credit hours of independent study, regardless of discipline, will apply to a bachelor’s degree. Differential Tuition: $55.

ME 4913. Independent Study. (0-0) 3 Credit Hours.
Prerequisite: Permission in writing (form available) from the instructor, the Department Chair, and Dean of the College. Independent reading, research, discussion, and/or writing under the direction of a faculty member. May be repeated for credit, but not more than 6 semester credit hours of independent study, regardless of discipline, will apply to a bachelor’s degree. Differential Tuition: $165.

ME 4953. Special Studies in Mechanical Engineering. (3-0) 3 Credit Hours.
Prerequisite: Will depend on the topic and must be identified before the course is scheduled; the minimum prerequisite must be ME 3173 (or ME 2173 in previous catalogs), or a higher-level engineering course depending on the topic. 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. Generally offered: Fall, Spring. Differential Tuition: $165. Course Fee: DL01 $75.
ME 4963. Mechanical Engineering Applications to Biomedical Systems. (3-0) 3 Credit Hours.
Prerequisites: EGR 2513, ME 3663, and ME 3813. Applications of dynamics, solid mechanics and fluid mechanics to biomedical systems. (Formerly titled Bioengineering.) Differential Tuition: $165.