Mechanical Engineering and Materials Science

The George R. Brown School of Engineering

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Lecturers
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Degrees Offered: B.A., B.S.M.E., B.S.M.S., M.M.E., M.M.S., M.S., Ph.D.

Studies in mechanical engineering may lead to specialization in one of several areas, including thermal sciences and energy conversion, computational mechanics, engineering mechanics, robotics, gas dynamics, and biomechanics. Studies in materials science focus on the fabrication, structure, and properties of materials used by engineers such as metals and their alloys, semiconductors, ceramics, glasses, polymers, and various composites.

The graduate program offers professional degrees in both materials science and engineering, which is based on undergraduate preparation in a number of related fields, and mechanical engineering, which permits specialization in thermal sciences and energy conversion, gas dynamics and hydrodynamics, stress analysis and mechanical behavior of materials, robotics and control, and aerospace engineering. Graduate students may also pursue research degrees. Faculty research interests fall in the areas of theoretical and rock mechanics, heat transfer, biomedical engineering, fluid dynamics, optimization theory, materials science, and aeronautics and astronautics. A joint M.B.A./Master of Engineering degree is also available in conjunction with the Jesse H. Jones Graduate School of Management.
Degree Requirements for B.A., B.S.M.E., and B.S.M.S. in Mechanical Engineering or Materials Science and Engineering

The B.A. program in either mechanical engineering, accredited by the Accreditation Board for Engineering and Technology (ABET), or materials science and engineering is highly flexible, involves less technical content, and allows students greater freedom to pursue areas of interest outside of engineering.

The two B.S. programs require more technical courses than the B.A. and prepare students for the professional practice of engineering. During their senior year, mechanical engineering students in the B.S. program take courses in computer-aided design and design applications while completing a major design project, and materials science and engineering students in the B.S. program work on a design problem in an industrial setting. The B.S.M.E. program is accredited by the ABET.

For general university requirements, see Graduation Requirements (pages 17–19). Lists of representative undergraduate courses and the usual order in which students take them are available from the department for either the B.A. or the B.S. programs in both mechanical engineering and materials science and engineering. All undergraduates must take the following courses:

**Basic Courses**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>CAAM 335</td>
<td>Foundations of Applied Mathematics I</td>
</tr>
<tr>
<td>CHEM 121–122</td>
<td>General Chemistry</td>
</tr>
<tr>
<td>MATH 101 and 102</td>
<td>Single Variable Calculus I and II</td>
</tr>
<tr>
<td>MATH 211</td>
<td>Ordinary Differential Equations and Linear Algebra</td>
</tr>
<tr>
<td>MECH 211</td>
<td>Engineering Mechanics</td>
</tr>
<tr>
<td>MSCI 301</td>
<td>Materials Science</td>
</tr>
<tr>
<td>PHYS 101</td>
<td>Mechanics</td>
</tr>
<tr>
<td>PHYS 102</td>
<td>Electricity and Magnetism</td>
</tr>
</tbody>
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**B.A. Program.** Students seeking the B.A. degree with a major in mechanical engineering must complete at least 63 semester hours in courses specified by the department. These include the basic courses (above) plus the following:

<table>
<thead>
<tr>
<th>Course Code</th>
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</thead>
<tbody>
<tr>
<td>CAAM 211</td>
<td>Introduction to Engineering Computation</td>
</tr>
<tr>
<td>CAAM 336</td>
<td>Foundations of Applied Mathematics II</td>
</tr>
<tr>
<td>MECH 200</td>
<td>Classical Thermodynamics</td>
</tr>
<tr>
<td>MECH 311</td>
<td>Mechanics of Deformable Solids</td>
</tr>
<tr>
<td>MECH 371</td>
<td>Fluid Mechanics I</td>
</tr>
<tr>
<td>MECH 411</td>
<td>Analytical Dynamics</td>
</tr>
<tr>
<td>MECH 481</td>
<td>Heat Transfer</td>
</tr>
</tbody>
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1 of the following paired courses:

<table>
<thead>
<tr>
<th>Course Code</th>
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<tbody>
<tr>
<td>MECH 372</td>
<td>Fluid Mechanics II</td>
</tr>
<tr>
<td>MECH 471</td>
<td>Applications of Thermodynamics</td>
</tr>
<tr>
<td>MECH 412</td>
<td>Vibrations</td>
</tr>
<tr>
<td>MECH 420</td>
<td>Feedback Control of Dynamic Systems</td>
</tr>
<tr>
<td>CIVI 400</td>
<td>Mechanics of Solids II</td>
</tr>
<tr>
<td>MECH 401</td>
<td>Mechanical Design Applications</td>
</tr>
</tbody>
</table>

Of the remaining hours required to reach a total of 123 hours at graduation, 21 hours must be in courses at the 300 level or higher.

Students seeking the B.A. degree with a major in materials science and engineering must complete at least 52 hours in courses specified by the department, plus additional hours for a total of 120 hours at graduation.

**B.S. Programs.** Degrees offered include the Bachelor of Science in Mechanical Engineering (B.S.M.E.) and the Bachelor of Science in Materials Science and Engineering (B.S.M.S.).

Students seeking the ABET-accredited B.S.M.E. must complete 92 semester hours in courses specified by the department. These include the basic courses (see above) plus the following:
CAAM 211 Introduction to Engineering Computation
CAAM 335 Foundations of Applied Mathematics II
CIVI 400 Mechanics of Solids II
ELEC 242 Introduction to Circuits and Electronics
MECH 200 Classical Thermodynamics
MECH 311 Mechanics of Deformable Solids
MECH 331 and 332 Junior Lab I and II
MECH 340 Industrial Process Lab
MECH 371 and 372 Fluid Mechanics I and II

MECH 401 Mechanical Design Applications
MECH 403 Computer-Aided Design
MECH 404 Senior Design Project (or MECH 408 Mechanical Design Project II)
MECH 411 Analytical Dynamics
MECH 412 Vibrations
MECH 431 Senior Lab I
MECH 471 Applications of Thermodynamics
MECH 481 Heat Transfer
MSCI 304 Applied Materials Engineering
1 approved major design elective (3 hours)

Students seeking the B.S.M.S. must complete at least 91 semester hours in courses specified by the department. These include the basic courses (page 194) plus the following:

CAAM 211 Introduction to Engineering Computation
CAAM 335 Matrix Analysis
CIVI 300 Mechanics of Solids
ELEC 241 Fundamentals of Electrical Engineering I or ELEC 243 Introduction to Electronics
MSCI 301 Materials Science
MSCI 303 Materials Science Junior Lab
MSCI 311 Introduction to Design
MSCI 401 Thermodynamics and Transport Phenomena in Materials Science
MSCI 402 Mechanical Properties of Materials
MSCI 404 Materials Engineering and Design
MSCI 406 Physical Properties of Solids or MSCI 415 Ceramics and Glasses

MSCI 411 Metallography and Phase Relations or MSCI 415 Ceramics and Glasses
MSCI 500 and 501 Materials Science Seminar
MSCI 535 Crystallography and Diffraction
MSCI 537 Materials Science Senior Lab
MSCI 594 Properties of Polymers

1 course from the following:
PHYS 201 Waves and Optics
CHEM 211 Organic Chemistry
CHEM 311 Physical Chemistry

Electives
1 approved science elective (at the 200 level or higher)
1 approved engineering science elective (not MSCI)
1 approved technical elective

Degree Requirements for M.M.E., M.M.S., M.S., and Ph.D. in Mechanical Engineering or Materials Science and Engineering

Professional Degree Programs. The professional degrees offered by this department, the Master of Mechanical Engineering (M.M.E.) and the Master of Materials Science (M.M.S.), involve a fifth year of specialized study, which is integrated with the four undergraduate years leading to either the B.A. or the B.S. degree in the same areas of interest. The professional degree programs are open to students who have shown academic excellence in their undergraduate studies.

For general university requirements, see Graduate Degrees (pages 72–73). For both the M.M.E. and M.M.S. degrees, students must complete 30 semester hours of course work. Lists of suggested courses are available from the department. Students should develop a specific plan of study based on their particular interests.
Research Degree Programs. The programs leading to the M.S. and Ph.D. degrees are open to students who have demonstrated outstanding performance in their undergraduate studies. The granting of a graduate research degree presupposes academic work of superior quality and a demonstrated ability to do original research.

For general university requirements, see Graduate Degrees (pages 72–73). Course requirements for the research degrees vary, depending on the extent of individual undergraduate preparation as well as each student’s performance in graduate courses and on qualifying examinations. For both the M.S. and Ph.D. degrees, students must present a thesis that comprises an original contribution to knowledge and defend it in a public oral examination.

See MECH (pages 419–425) and MSCI (pages 439–442) in the Courses of Instruction section.