The College of Engineering offers the following certificate and graduate programs:

- Graduate Certificate in Cloud Computing (p. 3)
- Master of Science in Advanced Materials Engineering (p. 1)

**Department of Biomedical Engineering** ([http://catalog.utsa.edu/graduate/engineering/biomedicalengineering](http://catalog.utsa.edu/graduate/engineering/biomedicalengineering))

- Master of Science in Biomedical Engineering ([http://catalog.utsa.edu/graduate/engineering/biomedicalengineering/#degreestext](http://catalog.utsa.edu/graduate/engineering/biomedicalengineering/#degreestext))
- Doctor of Philosophy in Biomedical Engineering ([http://catalog.utsa.edu/graduate/engineering/biomedicalengineering/#degreestext](http://catalog.utsa.edu/graduate/engineering/biomedicalengineering/#degreestext))

**Department of Civil and Environmental Engineering** ([http://catalog.utsa.edu/graduate/engineering/civilenvironmentalengineering](http://catalog.utsa.edu/graduate/engineering/civilenvironmentalengineering))

- Master of Civil Engineering ([http://catalog.utsa.edu/graduate/engineering/civilenvironmentalengineering/#degreestext](http://catalog.utsa.edu/graduate/engineering/civilenvironmentalengineering/#degreestext))
- Master of Science in Civil Engineering ([http://catalog.utsa.edu/graduate/engineering/civilenvironmentalengineering/#degreestext](http://catalog.utsa.edu/graduate/engineering/civilenvironmentalengineering/#degreestext))
- Doctor of Philosophy in Civil Engineering ([http://catalog.utsa.edu/graduate/engineering/civilenvironmentalengineering/#degreestext](http://catalog.utsa.edu/graduate/engineering/civilenvironmentalengineering/#degreestext))
- Doctor of Philosophy in Environmental Science and Engineering ([http://catalog.utsa.edu/graduate/engineering/civilenvironmentalengineering/#degreestext](http://catalog.utsa.edu/graduate/engineering/civilenvironmentalengineering/#degreestext))

**Department of Electrical and Computer Engineering** ([http://catalog.utsa.edu/graduate/engineering/electricalcomputerengineering](http://catalog.utsa.edu/graduate/engineering/electricalcomputerengineering))

- Master of Science in Electrical Engineering ([http://catalog.utsa.edu/graduate/engineering/electricalcomputerengineering/#degreestext](http://catalog.utsa.edu/graduate/engineering/electricalcomputerengineering/#degreestext))
- Master of Science in Computer Engineering ([http://catalog.utsa.edu/graduate/engineering/electricalcomputerengineering/#degreestext](http://catalog.utsa.edu/graduate/engineering/electricalcomputerengineering/#degreestext))
- Doctor of Philosophy in Electrical Engineering ([http://catalog.utsa.edu/graduate/engineering/electricalcomputerengineering/#degreestext](http://catalog.utsa.edu/graduate/engineering/electricalcomputerengineering/#degreestext))
- Integrated Bachelor's/Master's Program ([http://catalog.utsa.edu/graduate/engineering/electricalcomputerengineering/#degreestext](http://catalog.utsa.edu/graduate/engineering/electricalcomputerengineering/#degreestext))

**Department of Mechanical Engineering** ([http://catalog.utsa.edu/graduate/engineering/mechanicalengineering](http://catalog.utsa.edu/graduate/engineering/mechanicalengineering))

- Master of Science in Advanced Manufacturing and Enterprise Engineering ([http://catalog.utsa.edu/graduate/engineering/mechanicalengineering/#degreestext](http://catalog.utsa.edu/graduate/engineering/mechanicalengineering/#degreestext))
- Master of Science in Mechanical Engineering ([http://catalog.utsa.edu/graduate/engineering/mechanicalengineering/#degreestext](http://catalog.utsa.edu/graduate/engineering/mechanicalengineering/#degreestext))
- Doctor of Philosophy in Mechanical Engineering ([http://catalog.utsa.edu/graduate/engineering/mechanicalengineering/#degreestext](http://catalog.utsa.edu/graduate/engineering/mechanicalengineering/#degreestext))

**Master of Science Degree in Advanced Materials Engineering**

The Master of Science (M.S.) degree in Advanced Materials Engineering (MatE) at The University of Texas at San Antonio (UTSA) is an interdisciplinary graduate degree program offered by the College of Engineering. The M.S. in MatE degree program is directed by the Advanced Materials Engineering Graduate Program Committee and is currently administered by the Department of Electrical and Computer Engineering.

The Master of Science degree in Advanced Materials Engineering is designed to offer training opportunities for graduate students to gain the state-of-the-art technical knowledge and skill sets necessary for independent critical thinking, problem solving, and decision making to address multidisciplinary problems in materials engineering. The degree program also provides students with opportunities in taking multidisciplinary courses from the College of Engineering and other colleges at UTSA to enhance students' interdisciplinary research potentials as well as their technical leadership and entrepreneurship skills. The affiliated program faculty consists of UTSA graduate faculty who offers MatE core/concentration courses or serves on MatE Program/Supervising Committees during the current or previous catalog period. Each MatE program faculty is actively engaged in interdisciplinary research/education and brings to this program extensive and a wide range of expertise.

The program addresses three interlinked areas of knowledge in advanced materials engineering:

1. Structure-function relationships in materials, which determine behavior at the macro-, micro-, nano-, molecular- and atomic-levels;
2. Synthesis, characterization, measurement, and computational modeling of materials (ceramics, composites, metals, polymers, multifunctional, electronic and biomedical) especially those with novel multifunctional properties; and
3. Design and fabrication of advanced materials and devices that address current and future technological challenges in a wide range of applications including energy, communications, control and automation, health and medicine, nanotechnology, structural and environmental, and transportation.

The M.S. in MatE offers core courses to all enrolled students to achieve a common platform of understanding and knowledge. Subsequently, students will choose their concentrations according to materials classifications and applications. Currently two concentrations are offered:

- Concentration I – Multifunctional Electronic, Dielectric, Photonic and Magnetic Materials
- Concentration II – Multifunctional Biomedical Materials

Upon recommendation of the student's Supervising Professor and with the approval of the Program Director, a student may take graduate-level courses offered by other graduate programs related to materials science and engineering, including from the Management of Technology program, to augment the student's education and creativity in interdisciplinary areas and to better prepare the student for jobs in research and in the industry.

Both thesis and non-thesis options are available.

**Program Admission Requirements**

In addition to the University-wide graduate admission requirements, admission decisions will be made by the Admissions Committee based on a combination of the following:

- A bachelor’s degree in any discipline of engineering or sciences especially from materials science, physics or chemistry. A minimum
degree point average of 3.0 (on a 4.0 scale) in the last 60 semester credit hours of undergraduate studies.

- A statement of research experience, interests and goals
- 1 to 2 letter(s) of recommendation
- A satisfactory score on the Graduate Record Examination (GRE) test as evaluated by the Admissions Committee. An applicant’s performance on the GRE is considered with other criteria when making admission or competitive fellowship decisions but will not be used as the sole or primary criterion to end consideration of the applicant.
- Students whose native language is not English must achieve a minimum score of 60 on the Test of English as a Foreign Language (TOEFL) paper version, 79 on the TOEFL iBT, or 6.5 on the International English Language Testing System (IELTS).

Degree Requirements
The minimum number of semester credit hours required for the M.S. in MATE degree is 30 for the thesis option and 33 for the non-thesis option.

Thesis Option
The degree requires 30 semester credit hours including 24 technical course credits and 6 thesis credits identified as MATE 6983 Master’s Thesis Research. A total of 18 semester credit hours, including 9 credits of core courses in Group A and 9 credits courses (at least 6 credits from the chosen concentration) in Group B, must be taken to satisfy the depth and breadth requirement. Up to 6 credits may be taken from courses in Group C, including courses from outside of the College of Engineering with the approval of the Advanced Materials Engineering Graduate Program Committee. A current list of MATE graduate courses is available in the department office. No more than a total of 3 semester credit hours of MATE 6951, MATE 6952, or MATE 6953 Directed Research in Advanced Materials Engineering, MOTE 6971 or MOTE 6973 Special Problems, and Research Seminar (MOT 6011 or EE 6991) may be included.

Course listings of Group A, B, and C are common for both Thesis and Non-Thesis options.

A. Required Core Courses from Group A

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATE 5113</td>
<td>Functions, Evaluations and Technology of Advanced Materials</td>
</tr>
<tr>
<td>MOT 5163</td>
<td>Management of Technology</td>
</tr>
</tbody>
</table>

B. Concentration specific courses from Group B

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>EE 5403</td>
<td>Advanced Dielectric and Optoelectronic Engineering Laboratory</td>
</tr>
<tr>
<td>EE 5503</td>
<td>Introduction to Micro and Nanotechnology</td>
</tr>
<tr>
<td>EE 5693</td>
<td>Dielectric and Optoelectronic Devices</td>
</tr>
<tr>
<td>EE 6493</td>
<td>Advanced Topics in Electronic Materials and Devices</td>
</tr>
<tr>
<td>MATE 5213</td>
<td>Sensing and Sensor Materials</td>
</tr>
<tr>
<td>MATE 5223</td>
<td>Structure-Chemistry-Property Relations in Materials Science and Engineering</td>
</tr>
<tr>
<td>MATE 5233</td>
<td>Anisotropy and Crystalline Materials</td>
</tr>
</tbody>
</table>

C. Prescribed Electives from Group C

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATE 5243</td>
<td>Optic and Nonlinear Optical Materials</td>
</tr>
<tr>
<td>MATE 5253</td>
<td>Magnetic Materials and Electromagnetic Engineering</td>
</tr>
<tr>
<td>MATE 5393</td>
<td>Topics in Advanced Materials Engineering</td>
</tr>
<tr>
<td>MATE 5493</td>
<td>Topics in Materials Engineering and Application</td>
</tr>
</tbody>
</table>

D. Master’s Thesis (a minimum of 6 semester credit hours)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATE 6983</td>
<td>Master’s Thesis Research</td>
</tr>
</tbody>
</table>

Total Credit Hours
30
Non-Thesis Option
The degree requires 33 semester credit hours including 30 technical course credits and 3 project credits identified as MATE 6943 Master’s Project. A total of 24 semester credit hours, including 9 credits of core courses in Group A and 12 credits courses (at least 9 credits from the chosen concentration) in Group B must be taken to satisfy the depth and the breadth requirement. Up to 9 credits may be taken from courses in Group C, including courses from out of the College of Engineering with the approval of the Advanced Materials Engineering Graduate Program Committee. A current list of MATE graduate courses is available in the department office. No more than a total of 3 semester credit hours of MATE 6951, MATE 6952, or MATE 6953 Directed Research in Advanced Materials Engineering, MOTE 6971 or MOTE 6973 Special Problems, and Research Seminar (BME 6011 or EE 6991) may be included.

Course listings of Group A, B, and C are common for both Thesis and Non-Thesis options.

A. Required Core Courses from Group A 9

Group A. Required core courses:
- MATE 5113 Functions, Evaluations and Synthesis Technology of Advanced Materials
- MOT 5163 Management of Technology

B. Concentration specific courses from Group B 12

Group B. Concentration specific courses - at least 9 credits must be from the chosen concentration

Concentration I: Multifunctional Electronic, Dielectric, Photonic and Magnetic Materials
- EE 5403 Advanced Dielectric and Optoelectronic Engineering Laboratory
- EE 5503 Introduction to Micro and Nanotechnology
- EE 5693 Dielectric and Optoelectronic Devices
- EE 6493 Advanced Topics in Electronic Materials and Devices
- MATE 5213 Sensing and Sensor Materials
- MATE 5223 Structure-Chemistry-Property Relations in Materials Science and Engineering
- MATE 5233 Anisotropy and Crystalline Materials
- MATE 5243 Optic and Nonlinear Optical Materials
- MATE 5253 Magnetic Materials and Electromagnetic Engineering
- MATE 5393 Topics in Advanced Materials Engineering
- MATE 5493 Topics in Materials Engineering and Application

Concentration II: Multifunctional Biomedical Materials
- BME 6093 Topics in Biomedical Engineering
- BME 6743 Biophotonics
- BME 6903 Biomaterials
- BME 6933 Tissue-Biomaterials Interactions
- BME 6963 Fundamentals to Polymer Science with Select Biomedical Applications
- BME 6803 Experimental Biomechanics
- MATE 5513 Fundamentals of Microfabrication and Application or BME 6733 Microfabrication and Application
- MATE 5523 Biosensors: Fundamentals and Applications or BME 6753 Biosensors: Fundamentals and Applications
- MATE 5543 Current Analytical Tools for Biomaterials Characterizations
- MATE 5593 Topics in Advanced Materials Engineering
- MATE 5493 Topics in Materials Engineering and Application

C. Prescribed Electives from Group C 9

Group C. Prescribed elective courses. Additional elective courses may be added with approval of the Advanced Materials Engineering Graduate Program Committee.
- CHE 5263 Advanced Analytical Chemistry
- BME 6011 Research Seminar
- BME 6723 Bioinstrumentations
- BME 6943 Biomaterials and Cell Signaling
- EE 5293 Topics in Microelectronics
- EE 6991 Research Seminar
- EGR 6013 Advanced Engineering Mathematics I
- MATE 6951 Directed Research in Advanced Materials Engineering
- MATE 6952 Directed Research in Advanced Materials Engineering
- MATE 6953 Directed Research in Advanced Materials Engineering
- ME 5483 Finite Element Methods
- ME 5713 Mechanical Behavior of Materials
- ME 5743 Composite Materials
- MOT 5243 Essentials of Project and Program Management
- MOT 5253 Starting the High-Tech Firm
- MOT 5313 Emerging Technologies
- MOT 5323 Biotechnology Industry
- MOT 5333 Technological Drivers of Globalization
- PHY 7503 Topics in Experimental Physics
- PHY 7503 Topics in Experimental Physics

D. Master’s Project (a minimum of 3 semester credit hours) 3

MATE 6943 Master’s Project

Total Credit Hours 33

Degree plans must be consistent with the guidelines established by the Advanced Materials Engineering Graduate Program Committee. In general, undergraduate courses of the same concentration, general education courses, and courses satisfying provisional conditions for admission cannot be counted toward the total required degree credit hours. Students enrolled through integrated B.S./M.S. program should consult the Graduate Advisor or Record for details on fulfilling the integrated degree requirement.

Comprehensive Examination
Degree candidates are required to pass an oral comprehensive examination. The examination is to be administered in the form of a presentation of the thesis or research project to the student’s Supervising Committee. The Supervising Committee consists of minimum two (for non-thesis option) or three (for thesis option) graduate faculty members; two of the members including the Chair of the Committee must be graduate faculty members affiliated with the M.S. in Mate program. Students must register for 1 semester credit hour of Comprehensive Examination (MATE 6961), for the semester in which the examination is to be taken, if they are not enrolled in other courses.

College of Engineering
Graduate Certificate in Cloud Computing

The graduate certificate in Cloud Computing is a 12-semester-credit-hour program designed to equip technical professionals with the knowledge and technical skills necessary for a career in an organization that leverages cloud computing. The wide-range of use of cloud computing in today’s business, government and academic environments requires a broad range of competencies and understanding of how cloud computing influences a particular area. This certificate is designed to give a common framework of understanding cloud computing, as well as allow for specialization in specific areas, such as, cyber-security, cloud-infrastructure, and applications in cloud.

The certificate is administered by the College of Engineering in conjunction with the College of Business and the College of Sciences. The course requirements for each program focus may be found under the College of Engineering, the Department of Computer Science and the Department of Information Systems and Cyber Security.

Certificate Requirements

To satisfy the requirements for the Graduate Certificate in Cloud Computing, students must complete 12 semester credit hours as follows:

A. Required Course

Select one course:

- EE 5523 Introduction to Cloud Computing
- Or a cross-listed course in CS and IS. The entry course is taught through team teaching in which instructor from each college contributes to the subjects outlined in the course syllabus.

B. Track Electives

Select two courses from any of the following tracks:

Applications Track

- CS 5233 Artificial Intelligence
- CS 5263 Bioinformatics
- CS 5443 Database Management Systems
- CS 5463 Topics in Computer Science
- CS 5473 Data Mining
- CS 5493 Large-Scale Data Management
- CS 5573 Cloud Computing
- CS 6243 Machine Learning
- CS 6293 Advanced Topics in Bioinformatics
- EE 5243 Topics in Systems and Control (Topic: Data Analytics with Cloud Computing)
- EE 5243 Topics in Systems and Control (Topic: Programming Techniques for the Cloud)
- EE 6973 Special Problems (Topic: Machine Learning with Big Data)
- IS 6703 Introduction to Data Mining
- ME 5013 Topics in Mechanical Engineering (Topic: High Performance Computing)

Security Track

- CS 6353 Unix and Network Security
- CS 6393 Advanced Topics in Computer Security
- IS 5513 Fundamentals of Information Assurance
- IS 6363 Computer Forensics

Infrastructure Track

- CS 5103 Software Engineering
- CS 5123 Software Testing and Quality Assurance
- CS 6463 Advanced Topics in Computer Science
- CS 6463 Advanced Topics in Computer Science (Topic: Parallel and Distribute Systems Software)
- CS 6523 Distributed Operating Systems
- CS 6543 Networks
- CS 6553 Performance Evaluation
- CS 6643 Parallel Processing
- EE 5103 Engineering Programming
- EE 5453 Topics in Software Engineering (Topic: Advanced Data Structures and Algorithms)

C. Capstone Project

Select one course from the following (topics should be in the field of Cloud Computing):

- CS 6953 Independent Study
- EE 6943 Graduate Project
- EE 6953 Independent Study
- IS 6953 Independent Study

Total Credit Hours 12

Student may take cloud course(s) not listed above for credit with prior approval from Certificate Program Director.

Engineering (EGR) Courses

EGR 5023. Numerical Techniques in Engineering Analysis. (3-0) 3 Credit Hours.
Prerequisite: Graduate standing in engineering or consent of instructor. Advanced methods of applied mathematics, including numerical linear algebra, initial value problems, stability, convergence, partial differential equations, and optimization. Differential Tuition: $165.

EGR 5213. Topics in Systems Modeling. (3-0) 3 Credit Hours.
Prerequisite: Graduate standing in engineering. Systems analysis approach to formulating and solving engineering problems. Topics include operational research, mathematical modeling, optimization, linear and dynamic programming, decision analysis, and statistical quality control. Topic 1: Applied Operations Research. Application of operations research methods to practical engineering problems. Topic 2: Engineering Systems Modeling. Modeling of modern engineering systems for operational and management control. May be repeated for credit as topics vary. (Same as CE 5013. Credit cannot be earned for both EGR 5213 and CE 5013.) Differential Tuition: $165.

EGR 5233. Advanced Quality Control. (3-0) 3 Credit Hours.
Prerequisite: Graduate standing in engineering or consent of instructor. Methods and techniques for process control, process and gage capabilities, inspection plans, American National Standard, and recent advanced techniques. Tour of manufacturing industry. Case studies in process control, outgoing quality, and costs. A project, assigned by a manufacturing company, is required, along with a final presentation of the project. Differential Tuition: $165.

EGR 5703. Advanced Scientific Visualization. (3-0) 3 Credit Hours.
Prerequisite: Graduate standing in engineering or consent of instructor. Topics include 3D image display and generation techniques, visual thinking process, interaction with visualization, efficiency of visualization on sparse grid, haptic rendering and control, and immersive 3D programming. Differential Tuition: $165.
EGR 5713. High Performance Computing. (3-0) 3 Credit Hours.
Prerequisite: Graduate standing in engineering or consent of instructor. Topics include scientific computing in UNIX/LINUX environment, instruction on several import UNIX applications, various parallelization styles of computing, and application programming interfaces (APIs) in scientific applications. Differential Tuition: $165.

EGR 6013. Advanced Engineering Mathematics I. (3-0) 3 Credit Hours.
Prerequisites: EGR 2323 and EGR 3323, or equivalent courses. Advanced methods of applied mathematics, including vector differential calculus, linear algebra, functional space and their applications to engineering problems. (Same as BME 6033. Credit cannot be earned for both EGR 6013 and BME 6033.) (Formerly titled “Analytical Techniques in Engineering Analysis.”) Differential Tuition: $165.

EGR 6023. Advanced Engineering Mathematics II. (3-0) 3 Credit Hours.
Prerequisites: EGR 2323 and EGR 3323, or equivalent courses. Advanced methods of applied mathematics. Topics may include solution methods of partial differential equations, complex analysis, optimization theory, other topics in engineering mathematics and their applications to engineering problems. May be repeated for credit as topics vary. Differential Tuition: $165.

EGR 6033. Linear and Mixed Integer Optimization. (3-0) 3 Credit Hours.
Prerequisite: ME 2173 or equivalent. Graduate standing in engineering or consent of instructor. Introduction to the theory of linear programming and duality, algorithms for solving linear programs, network simplex, integer and mixed integer programming (e.g., simplex, branch and bound and branch and cut). This course provides an overview of optimization theory and algorithms as well as emphasizes its applications in different areas of Engineering. Differential Tuition: $165.