Minor and Certificate Programs

Minors

The transcript-recognized undergraduate academic minor must be completed in conjunction with an undergraduate degree at The University of Texas at Austin. For more information regarding the requirements for achieving a minor, including a comprehensive list of minors, please visit the Minor and Certificate Programs section of the *Undergraduate Catalog*.

Materials Science and Engineering Minor

The transcript-recognized undergraduate academic minor in materials science and engineering must be completed in conjunction with an undergraduate degree at The University of Texas at Austin in one of the following majors: chemistry, physics, aerospace engineering, biomedical engineering, chemical engineering, electrical and computer engineering, or mechanical engineering; students pursuing an integrated undergraduate/graduate program must complete the requirements for the minor within one year after completing the undergraduate requirements of their program. For more information regarding the requirements for achieving a minor, including a comprehensive list of minors, please visit the Minors and Certificate Programs section of the *Undergraduate Catalog*. Details about the minor in Materials Science and Engineering are available at http://tmi.utexas.edu/academics/undergraduate-minor-materials-science-engineering/.

Admissions

To be considered for admission into the Minor Program for Materials Science and Engineering, students must meet the following requirements:

- The minor must be completed in conjunction with an undergraduate degree in one of the seven supported majors of chemistry, physics, aerospace engineering, biomedical engineering, chemical engineering, electrical and computer engineering, or mechanical engineering.
- Students must have completed Mathematics 408C, Mathematics 408D, Mathematics 427J, Chemistry 301, Physics 303K and Physics 303L, or equivalent and all with a grade of *C-* or higher.
- Students who have completed 30 hours or more and have not taken more than 60 hours will be encouraged to apply online at the earliest possible date. Applications will be reviewed continuously throughout the year.

Requirements

The requirements for the minor in Materials Science and Engineering will consist of 15 credit hours towards the minor. All students will be required to take a three-credit hour, laboratory-based bridge course (MSE 360M). The remainder of the required courses required for the minor will consist of a sequence of courses that are specific to the major degree and which are detailed below.

If students are interested in additional coursework, they can see http://tmi.utexas.edu/academics/undergraduate-minor-materials-science-engineering/ for a complete list of courses that would serve as optional electives. Courses beyond 15 hours are not required for the completion of the minor.

Chemistry Majors

Requirements		Hours
MSE 360M	Experiments in Materials Science and Engineering	3
CH 353	Physical Chemistry I	3
PHY 355	Modern Physics and Thermodynamics	3
CHE 355	Introduction to Polymers	3
M E 349	Corrosion Engineering	3
All classes must be taken on the letter-grade basis. The student must earn a combined grade point average of at least 2.00 in these courses.		

Physics Majors

Requirements		Hours
MSE 360M	Experiments in Materials Science and Engineering	3
PHY 369	Thermodynamics and Statistical Mechanics	3
CH 367C	Materials Chemistry	3
or CH 367L	Macromolecular Chemistry	
or M E 336	Materials Processing	
CH 354S	Elements of Spectroscopy	3
ECE 334K	Quantum Theory of Electronic Materials	3
All classes must be taken on the letter-grade basis. The student must earn a combined grade point average of at least 2.00 in these courses.		

Aerospace Engineering Majors

Requirements		Hours
MSE 360M	Experiments in Materials Science and Engineering	3
M E 310T	Applied Thermodynamics	3
ASE 357	Mechanics of Composite Materials	3
ASE 324L	Aerospace Materials Laboratory	3
M E 349	Corrosion Engineering	3
or M E 336	Materials Processing	
All classes must be taken on the letter-grade basis. The student must earn a combined grade point average of at least 2.00 in these courses.		

Biomedical Engineering Majors

Requirements		Hours
MSE 360M	Experiments in Materials Science and Engineering	3
BME 335	Engineering Probability and Statistics	3
BME 373	Tissue, Scaffold, and Cell Biomechanics Applications	3
or BME 363	Bioelectronics and Biointerfaces	
or BME 379	Tissue Engineering	
or CHE 339T	Cell and Tissue Engineering	
or CHE 355	Introduction to Polymers	
ECE 334K	Quantum Theory of Electronic Materials	3
or ECE 339	Solid-State Electronic Devices	

ASE 357	Mechanics of Composite Materials	3
or M E 336	Materials Processing	
or M E 349	Corrosion Engineering	
or M E 359	Materials Selection	
or M E 378K	Mechanical Behavior of Materials	
All classes must be taken on the letter-grade basis. The student must earn a combined grade point average of at least 2.00 in these courses.		

Chemical Engineering Majors

Requirements		Hours
MSE 360M	Experiments in Materials Science and Engineering	3
CH 353	Physical Chemistry I	3
CHE 355	Introduction to Polymers	3
CH 367C	Materials Chemistry	3
CH 375P	Advanced Topics in Polymer Science (Topic 1: Advanced Polymer Synthesis)	3
All classes must be taken on the letter-grade basis. The student must earn a combined grade point average of at least 2.00 in these courses.		

Electrical and Computer Engineering Majors

Requirements		Hours
MSE 360M	Experiments in Materials Science and Engineering	3
PHY 369	Thermodynamics and Statistical Mechanics	3
ECE 325	Electromagnetic Engineering	3
CH 354S	Elements of Spectroscopy	3
or CH 367C	Materials Chemistry	
ECE 334K	Quantum Theory of Electronic Materials	3
All classes must be taken on the letter-grade basis. The student must earn a combined grade point average of at least 2.00 in these courses.		

Mechanical Engineering Majors

Requirements		Hours
MSE 360M	Experiments in Materials Science and Engineering	3
M E 316T	Thermodynamics	3
PHY 355	Modern Physics and Thermodynamics	3
or PHY 375S	Introductory Solid-State Physics	
or PHY 369	Thermodynamics and Statistical Mechanics	
or CH 353	Physical Chemistry I	
M E 378K	Mechanical Behavior of Materials	3
M E 349	Corrosion Engineering	3
or ASE 357	Mechanics of Composite Materials	
All classes must be taken on the letter-grade basis. The student must earn a combined grade point average of at least 2.00 in these courses.		

Robotics Minor

The transcript-recognized undergraduate academic Robotics Minor must be completed in conjunction with an undergraduate degree at The University of Texas at Austin in one of the following majors: Aerospace Engineering, Electrical and Computer Engineering, Computational Engineering, Mechanical Engineering, or Computer Science. The minor is administered by Texas Robotics as a collaboration between the Cockrell School of Engineering and the College of Natural Sciences. Details about the minor in robotics are available at https://robotics.utexas.edu/.

Admissions

To be considered for admissions into the Robotics Minor, students must meet the following requirements:

- The minor must be completed in conjunction with an undergraduate degree in one of the following supported majors of Computer Science, Aerospace Engineering, Electrical and Computer Engineering, Computational Engineering, or Mechanical Engineering.
- Students who have completed 24 hours or more in residence will be encouraged to apply online at the earliest possible date. Applications will be reviewed once a semester (Fall and Spring).

Requirements

The requirements for the Robotics Minor consist of 15 credit hours towards the minor. All students will be required to take a three-credit-hour, gateway course (Robotics 350) that will prepare students to take robotics minor courses in areas outside of their declared major. In addition to the gateway course, students must take 4 courses; each course must be from a different content area. There are five content areas: hardware; programming; modeling and control; sensing, perception and planning; and machine learning. Below is a list of approved courses in each content area that count towards the Robotics Minor.

All classes must be taken on the letter-grade basis. The student must earn a combined grade point average of at least 2.00 in these courses.

Requirements		Hours
RBT 350	Gateway to Robotics	3
One course from at least four different content areas:		12
Hardware Courses:		
M E 348E	Advanced Mechatronics I	
M E 350R	Robot Mechanism Design	
Programming Courses:		
M E 369P	Application Programming for Engineers	
C S 330F	F1/10 Autonomous Driving	
ECE 445L	Embedded Systems Design Laboratory	
ECE 445M	Embedded and Real-Time Systems Laboratory	
ASE 479W	Aerial Robotics	
Modeling and Control Courses:		
M E 364L	Automatic Control System Design	
ASE 370C	Feedback Control Systems	
ECE 362K	Introduction to Automatic Control	
ASE 330M	Linear System Analysis	
M E 354M	Biomechanics of Human Movement	
M E 372J	Robotics and Automation	
C S 330F	F1/10 Autonomous Driving	

Sensing, Perception, and Planning Courses:	
C S 330F	F1/10 Autonomous Driving
M E 372J	Robotics and Automation
ASE 479W	Aerial Robotics
ECE 445L	Embedded Systems Design Laboratory
ECE 445M	Embedded and Real-Time Systems Laboratory
ECE 374N	Neural Engineering
C S 376	Computer Vision
ECE 371P	Introduction to Computer Vision
Machine Learning Courses:	
C S 342	Neural Networks
C S 343	Artificial Intelligence
C S 363M	Principles of Machine Learning I
COE 379L	Topics in Computational Engineering (Topic 1: Introduction to Machine Learning and Data Sciences)
ECE 460J	Data Science Laboratory
ECE 361E	Machine Learning and Data Analytics for Edge Artificial Intelligence
ECE 374N	Neural Engineering
ECE 461P	Data Science Principles
Total Hours	**15**

Sustainable Energy Minor

The Sustainable Energy minor is restricted to the following majors: chemistry, BS in environmental science, BS in geological sciences, architectural engineering, chemical engineering, civil engineering, electrical and computer engineering, environmental engineering, geosystems engineering and hydrogeology, mechanical engineering, or petroleum engineering.

Students pursuing an integrated undergraduate/graduate program must complete the requirements for the minor within one year after completing the undergraduate requirements of their program. For more information regarding the requirements for achieving a minor, including a comprehensive list of minors, please visit the Minors and Certificate Programs section of the Undergraduate Catalog. Details about the minor in Sustainable Energy are available at https://www.pge.utexas.edu/undergraduate/undergraduate- minor-sustainable-energy/.

Admissions

To be considered for admission into the Minor Program for Sustainable Energy, students must meet the following requirements:

• The minor is restricted to the following majors: chemistry, BS in environmental science, BS in geological sciences, architectural engineering, chemical engineering, civil engineering, electrical and computer engineering, environmental engineering, geosystems engineering, mechanical engineering, or petroleum engineering.
• Students must have completed Mathematics 408C, 408D, 427J, Chemistry 301, Physics 303K, and 303L, or equivalent with a grade of C- or higher.
• Students who have completed 30 to 60 hours will be encouraged to apply online at the earliest possible date. Application deadlines are March 1 for summer or fall and October 1 for spring.

Requirements

The Sustainable Energy minor requires a total of 18 credit hours towards the minor. The following nine hours are required for all students: Engineering Studies 369N, Mechanical Engineering 363M, and Geological Sciences 302C. The remaining nine credit hours consist of six credit hours from students' major field of study and three credit hours from outside. These courses must be selected from the list of approved courses below.

If students are interested in additional coursework, they can select additional electives from this list. Courses beyond 18 credit hours are not required for the completion of the minor.

Required Courses for All Majors

Requirements		Hours
E S 369N	Sustainability Issues in Energy	3
M E 363M	Energy Technology and Policy	3
GEO 302C	Climate: Past, Present, and Future	3
All classes must be taken on the letter-grade basis. The student must earn a combined grade points average of at least 2.00 in these courses.		

Approved Courses for Remaining Nine Credit Hours for All Majors

Requirements		Hours
ARE 346N	Building Environmental Systems	3
ARE 371	Energy Simulation in Building Design	3
CH 353	Physical Chemistry I	3
CH 367C	Materials Chemistry	3
C E 341	Introduction to Environmental Engineering	3
C E 367R	Optimization Techniques for Transportation Engineers	3
C E 369L	Air Pollution Engineering	3
C E 370L	Climate Change Mitigation	3
CHE 341	Design for Environment	3
CHE 346F	Atmospheric Chemistry and Physics	3
ECE 339S	Solar Energy Conversion Devices	3
ECE 362G	Smart Grids	3
ECE 369	Power Systems Engineering	3
ECE 462L	Power Electronics Laboratory	4
EVE 310	Sustainable Systems Engineering	3
EVE 312	Environmental Engineering and Science	3
GEO 330K	Energy Exploration	3
GEO 341	Mineral Resources, Society, and the Environment	3
GEO 347D	Global Warming	3
M E 336P	Concepts in Nuclear and Radiation Engineering	3
M E 374T	Renewable Energy Technology	3
M E 378E	Nanotechnology for Sustainable Energy	3
PGE 379	Studies in Petroleum and Geosystems Engineering (Topic 5: Energy and the Environment)	3

PGE 379	Studies in Petroleum and Geosystems Engineering (Topic 3: Geothermal and Sustainable Energy Resources)	3
PGE 379	Studies in Petroleum and Geosystems Engineering (Topic 4: Carbon Capture and Storage)	3
All classes must be taken on the letter-grade basis. The student must earn a combined grade points average of at least 2.00 in the courses selected for their program of study.		

Certificates

National Academy of Engineering Grand Challenges Scholars Program Certificate

The National Academy of Engineering Grand Challenges Scholars Program (GCSP) certificate is designed to be complementary, not additive, to a student's traditional academic path. The GCSP certificate provides students with the scholarship network and formal recognition from the National Academy of Engineering, while typically requiring only one course beyond their standard degree program.

The GCSP certificate program is designed to offer students from all majors and all years an introduction to the program through Engineering Studies 377, an array of university-wide course connections, and mentorship. GC Scholars choose between 18 and 24 hours of approved coursework from a broad range of offerings that align with the five key program components. The five key curriculum components include facing the 21st Century Engineering Grand Challenges with (1) entrepreneurship and (2) service-learning by (3) understanding global dimensions through (4) research and (5) interdisciplinary curriculum. Each Scholar must choose at least one class that emphasizes each one of the components. Scholars will be advised on progress regularly by faculty affiliated with the program, and will present their work at an annual GCSP colloquium.

The certificate requirements are:

Requirements		Hours
E S 377	Topics in Engineering (Topic 2: 21st Century Grand Challenges)	3
At least 18 hours of approved courses from GC Scholar Coursework Program Plan		18
Be a student of good standing		
Complete courses, a research project, a community project, a comprehensive reflective report, and a final design, which are evaluated with aligned rubrics.		

Computational Science and Engineering Certificate

The Cockrell School sponsors the transcript-recognized Certificate in Computational Science and Engineering along with the Jackson School of Geosciences, the College of Liberal Arts, and the College of Natural Sciences.

The foundations of science and engineering are under rapid, dramatic, and irreversible change brought on by the advent of the computer. Steady growth in computer capabilities, and enormous expansion in the scope and sophistication of computational modeling and simulation, have added computation as the third pillar of scientific discovery and have revolutionized engineering practice. Computational science and engineering can affect virtually every aspect of human existence, including the health, security, productivity, and competitiveness of nations.

The Computational Science and Engineering Certificate program is sponsored by the Cockrell School of Engineering, the Jackson School of Geosciences, the College of Liberal Arts, and the College of Natural Sciences; it is administered by the Oden Institute for Computational Engineering and Sciences. The program offers highly qualified upper-division students an opportunity for in-depth study and research in computational science and engineering, including computational and applied mathematics, numerical simulation, scientific computation, and visualization. A student who completes the general requirements listed on Transcript-Recognized Programs and the specific requirements below receives recognition on his or her University transcript and a letter from the director of the Oden Institute that describes the program and the work completed. Along with supporting letters from supervising faculty and graduate mentors, these are valuable assets for students applying to graduate school and pursuing competitive job opportunities.

To apply for admission, students must have completed 60 semester hours of coursework, must have a grade point average of at least 3.00, and must have taken coursework in calculus.

Students must complete 18 semester hours of approved coursework with a grade of at least *C-* in each course. A student's overall GPA in certificate courses must be 3.00 or greater.

Requirements	Hours
Students must take at least one course in each of the following areas:	18
Upper Division Mathematics	
Basic Programming	
Numerical Applications	
Advanced Computing	
Electives	
Scientific Computing Project [1]	
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1. To be supervised by a member of the computational science, engineering, and mathematics (CSEM) graduate program faculty. The research project is completed in a three-semester-hour research methods or individual instruction course, which the student should take during the senior year. The research project may include mentoring by Oden Institute postdoctoral fellows and CSEM graduate students as part of a vertical instructional research team.

With the approval of the certificate program's faculty advisor, course substitutions may be made within the broad area of computational science and engineering.

Some courses on the approved course list may be restricted by the department offering the course. Please note that the CSE Certificate Program cannot ask the department to waive prerequisites or force the department to lift restrictions on their courses.

A list of approved courses is available at https://www.oden.utexas.edu/programs/cse-certificate/ and in the Oden Institute for Computational Engineering and Sciences, POB 4.110

Humanitarian Engineering Certificate

The undergraduate Humanitarian Engineering Certificate provides students with the opportunity to develop expertise in designing and/or implementing projects or products for traditionally underserved populations, e.g., the physically or mentally challenged, low-income or rural communities, or communities experiencing humanitarian crises.

The participants will develop not only technical knowledge but also awareness of social, political, and/or economic circumstances that may be important to the development of engineering solutions for underserved populations.

The certificate consists of 18 hours. Students must receive a grade of at least a *C-* in each course applied toward the certificate and have a cumulative grade point average of at least 3.0 in the courses presented to fulfill the certificate. The certificate program will be managed by the Committee for the Humanitarian Engineering Certificate in the J. Mike Walker Department of Mechanical Engineering. Students may apply for participation in the program at any time during their enrollment at The University of Texas at Austin, but it is recommended that they apply prior to starting the requirements. Students must contact the Committee for the Humanitarian Engineering Certificate in the J. Mike Walker Department of Mechanical Engineering to apply for the certificate in the semester in which they are completing the requirements and graduating.

The course requirements for the certificate are:

Requirements		Hours
Three hours from the following:		3
UGS 302	First-Year Signature Course [1]	
UGS 303	First-Year Signature Course [1]	
ANT 302	Cultural Anthropology	
CTI 302	Classics of Social and Political Thought	
GRG 305	This Human World: An Introduction to Geography	
PHY 303L & PHY 103N	Engineering Physics II and Laboratory for Physics 303L	4
Humanitarian engineering project chosen from the following:		4
E S 277K & E S 277L	Project Development with Underserved Communities and Project Design with Underserved Communities	
E S 225C & E S 225D	Humanitarian Product Design and Humanitarian Product Prototyping	
Approved project design course such as M E 466K [2]		
Approved independent study research project [2]		
M E 120C	Humanitarian Engineering Seminar	1
Three hours from the following:		3
GRG 344K	Global Food, Farming, and Hunger	
SOC 369K	Population and Society	
GRG 336	Contemporary Cultural Geography	
GRG 350K	Geographies of Globalization	
GRG 357	Medical Geography	
SOC 321G	Global Health Issues and Health Systems	
CTI 323	Might and Right among Nations	
PHL 325D	Environmental Ethics and Philosophy	
PHL 325M	Medicine, Ethics, and Society	
ANS 361	Topics in Asian Studies (Topic 31: Global Markets and Local Cultures)	
HIS 366N	Topics in History (Topic 18: Global History of Disease)	
ADV 324	Communicating Sustainability	
CMS 340K	Communication and Social Change	
Three hours from the following: [3]		3
ARE 323K	Project Management and Economics	
ARE 346N	Building Environmental Systems	
BME 339	Biochemical Engineering	
BME 342	Biomechanics of Human Movement	
BME 344	Biomechanics	
BME 352	Engineering Biomaterials	
BME 358	Medical Decision Making	
C E 341	Introduction to Environmental Engineering	
C E 342	Water and Wastewater Treatment Engineering	
C E 364	Design of Wastewater and Water Treatment Facilities	
C E 369R	Indoor Air Quality	
C E 374K	Hydrology	
CHE 339	Introduction to Biochemical Engineering	
CHE 339T	Cell and Tissue Engineering	
CHE 341	Design for Environment	
CHE 342	Chemical Engineering Economics and Business Analysis	
CHE 357	Technology and Its Impact on the Environment	
ECE 339S	Solar Energy Conversion Devices	
ECE 362R	Renewable Energy and Power Systems	
ECE 362S	Development of a Solar-Powered Vehicle	
ECE 374K	Biomedical Electronic Instrument Design	
ECE 374L	Applications of Biomedical Engineering	
M E 337F	Nuclear Environmental Protection	
M E 350D	Design and Control of Robots for Rehabilitation	
M E 354M	Biomechanics of Human Movement	
M E 374S	Solar Energy Systems Design	
M E 362S	Development of a Solar-Powered Vehicle	
M E 363M	Energy Technology and Policy	
M E 374T	Renewable Energy Technology	
M E 371D	Medical Device Design and Manufacturing	
M E 378E	Nanotechnology for Sustainable Energy	

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1. For an approved list of courses, please see your advisor.

2. Approval for these options must be obtained in advance from the Committee for the Humanitarian Engineering Certificate.

3. Additional courses may be substituted for those listed upon approval by the advisor for Humanitarian Engineering.