Bachelor of Science in Computational Engineering

Computational engineering is a relatively new field in engineering that recognizes the increasing demand for advanced computational methods in engineering practice. Computational engineering in this context refers to the study and development of computer algorithms that translate mathematical and physical descriptions of engineering problems into languages and software that computers can process. This emphasis distinguishes computational engineering from computer science and computer engineering. Computational engineers must have basic knowledge of fundamental engineering and science, with more advanced knowledge of mathematics, algorithms and software engineering and design. Because of their extensive education in these disciplines, computational engineers can work in a variety of areas.

The objectives of the computational engineering degree program are to prepare students for professional practice in engineering; to prepare students for such post-baccalaureate study as their aptitudes and professional goals may dictate; to instill in students a commitment to acquire and apply new knowledge and to ethical behavior throughout their professional careers; and to make students aware of the global and societal effects of technology. To meet these objectives, the faculty has designed a rigorous curriculum that emphasizes fundamentals in the basic sciences and the humanities, integrates classroom and laboratory experiences in engineering, with advanced instruction in mathematics, statistics and computational science. The curriculum requires students to use modern engineering tools and computer technology, to work individually, and to practice teamwork.

The initial coursework in the computational engineering curriculum emphasize fundamental material along with engineering sciences, while the later coursework goes into further depth in mathematics, algorithms, computer languages, software engineering and design, and experimentation. The major offers technical electives in the third and fourth years where students may choose from a variety of courses that orient them towards different engineering applications and better prepare those students who may choose to pursue a graduate degree.

Student Outcomes

Attainment of these outcomes prepares graduates to enter the professional practice of engineering. Computational engineering graduates should demonstrate:

- An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
- 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
- An ability to communicate effectively with a range of audiences
- 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
- 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
- An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
- An ability to acquire and apply new knowledge as needed, using appropriate learning strategies

Program Educational Objectives

Within a few years of graduation, computational engineering graduates should:

- Contribute to the economic development of Texas and the nation through the ethical practice of computational engineering in industry and public service
- Exhibit leadership in technical or business activity through engineering ability, communication skills, and knowledge of contemporary and global issues
- Continue to educate themselves through professional study and personal research
- Be prepared for admission to, and to excel in, the best graduate programs in the world
- Use their engineering ability and creative potential to create technology that will improve the quality of life in society

Portable Computing Devices

Students entering computational engineering are required to have access to a portable computing device capable of running the software tools required for undergraduate engineering analyses (MATLAB, SOLIDWORKS, Word, Excel, etc.) and accessing to the remote server for the department. This device does not need to be brought to campus on a daily basis, but individual courses may require that the device be brought to certain lectures, labs, and/or exams. Minimum and recommended specifications may be found on the department website.

Curriculum

Course requirements include courses within the Cockrell School of Engineering and other required courses. In addition, each student must complete the University's Core Curriculum. In some cases, a course that fulfills one of the following requirements may also be counted toward core curriculum or flag requirements; these courses are identified below.

In the process of fulfilling engineering degree requirements, students must also complete coursework to satisfy the following flag requirements: one independent inquiry flag, one quantitative reasoning flag, one ethics flag, one global cultures flag, one cultural diversity in the United States flag, and two writing flags. The independent inquiry flag, the quantitative reasoning flag, the ethics flag, and both writing flags are carried by courses specifically required for the degree; these courses are identified below. Courses that may be used to fulfill flag requirements are identified in the Course Schedule.

Courses used to fulfill technical elective requirements must be approved by the computational engineering faculty before the student enrolls in them.

The student must take all courses required for the degree on the letter-grade basis and must earn a grade of at least *C-* in each course, except for those listed as Remaining Core Curriculum Courses, including flags. He or she must also maintain grade point averages of at least 2.00 in the major area of study and in required technical courses as described in Academic Standards, and a cumulative University grade point average of at least 2.00 as described in General Information.

Requirements		Hours
Computational Engineering Courses		
COE 301	Introduction to Computer Programming	3
COE 311K	Engineering Computation	3
COE 321K	Computational Methods for Structural Analysis	3
COE 322	Scientific Computation	3
COE 332	Software Engineering and Design	3
COE 347	Introduction to Computational Fluid Dynamics	3
COE 352	Advanced Scientific Computation	3
COE 374	Senior Design Project (writing flag and independent inquiry flag)	3
Aerospace Engineering		
ASE 320	Low-Speed Aerodynamics	3
ASE 330M	Linear System Analysis	3
ASE 375	Electromechanical Systems	3
Chemistry		
CH 301	Principles of Chemistry I (part II science and technology)	3
Engineering Mechanics		
E M 306	Statics	3
E M 311M	Dynamics	3
E M 319	Mechanics of Solids	3
Mathematics		
M 408C	Differential and Integral Calculus (mathematics; quantitative reasoning flag)	4
M 408D	Sequences, Series, and Multivariable Calculus	4
M 427J	Differential Equations with Linear Algebra (quantitative reasoning flag)	4
M 427L	Advanced Calculus for Applications II	4
COE 362	Engineering Probability and Statistics	3
or M 362K	Probability I	
Mechanical Engineering Courses		
M E 210	Engineering Design Graphics	2
M E 310T	Applied Thermodynamics	3
Physics		
PHY 105M	Laboratory For Physics 302K, 303K, and 317K	1
PHY 105N	Laboratory For Physics 302L, 303L, and 317L	1
PHY 303K	Engineering Physics I (part I science and technology; quantitative reasoning flag)	3
PHY 303L	Engineering Physics II (part I science and technology; quantitative reasoning flag)	3
Other required courses		
Approved technical electives		15
E S 333T	Engineering Communication	3
Rhetoric and Writing		
RHE 306	Rhetoric and Writing (English composition)	3
Remaining Core Curriculum Courses		
E 316L	British Literature [1]	3
or E 316M	American Literature	
or E 316N	World Literature	
or E 316P	Masterworks of Literature	
American and Texas government [2]		6
American history [2]		6
Social and behavioral sciences [3]		3
Visual and performing arts [3]		3
UGS 302	First-Year Signature Course [4]	3
or UGS 303	First-Year Signature Course	
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1. Some sections of the English humanities courses (E 316L, 316M, 316N, 316P) carry a global cultures or cultural diversity flag.		
2. Some sections carry a cultural diversity flag.		
3. Some sections carry a global cultures and/or cultural diversity flag.		
4. In UGS 302, all sections carry a writing flag; in UGS 303, some sections carry a writing flag.		
Total Hours		**122**

Integrated Bachelor of Science in Computational Engineering/Master of Science in Computational Science, Engineering, and Math Program

The integrated degree program leads to sequential awarding of a Bachelor of Science in Computational Engineering (BSCompE) degree followed by a Master of Science in Computational Science, Engineering, and Math (MSCSEM) degree. The Integrated BSCompE/MSCSEM program is designed to prepare students to become leaders in Computational Science, Engineering, and Math in academia and in industry. #The program requires completion of a total of 152 credit hours: 122 SCH for the BSCompE degree and 30 SCH for the MSCSEM degree. Students can complete the integrated program in five academic years of full-time study.

Information regarding the integrated program requirements and policies may be obtained from the Computational Science, Engineering, and Math Academic Advising Office in#POB 4.102.

Technical Electives

The technical electives allow students to focus in a specific area. Of the 15 hours in the degree plan, the following distribution is required. The list of approved electives may be found on the department website.

- Advanced Elective: At least six hours must be chosen from the approved list of advanced electives.
- Math/Computational Elective: Up to six hours may be chosen from the approved list of math/computational electives or six more hours of advanced electives.
- Foundational Elective: Three hours must be chosen from the approved list of foundational electives.