

Computational Engineering (BSCompE)

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.

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.

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

Total Hours Required: 122

Plan of Study

The Plan of Study is a suggested four-year course sequence to support academic planning and serves as a helpful guide. Currently enrolled students should meet with their academic advisor to tailor their course selections and timelines to their individual goals and circumstances.

Course	Title	Hours
Year 1		
Semester 1		
CH 301	Principles of Chemistry I	3
M 408C	Differential and Integral Calculus	4
RHE 306	Rhetoric and Writing	3
<u>Social and Behavioral Sciences (080)</u>		3
<u>First-Year Signature Course (090)</u>		3
Hours		16
Semester 2		
COE 301	Introduction to Computer Programming	3
M 408D	Sequences, Series, and Multivariable Calculus	4
PHY 303K	Engineering Physics I	3
PHY 105M	Laboratory For Physics 302K, 303K, and 317K	1
M E 210	Engineering Design Graphics	2
<u>U.S. History (060)</u>		3
Hours		16

Year 2		
Semester 1		
E M 306	Statics	3
COE 322	Scientific Computation	3
M 427J	Differential Equations with Linear Algebra	4
PHY 303L	Engineering Physics II	3
PHY 105N	Laboratory For Physics 302L, 303L, and 317L	1
M E 310T	Applied Thermodynamics	3
Hours		17
Semester 2		
COE 311K	Engineering Computation	3
COE 332	Software Engineering and Design	3
E M 311M	Dynamics	3
M 427L	Advanced Calculus for Applications II	4
<u>American and Texas Government (070)</u>		3
Hours		16
Year 3		
Semester 1		
ASE 320	Low-Speed Aerodynamics	3
E S 333T	Engineering Communication	3
COE 352	Topics in Advanced Scientific Computations	3
E M 319	Mechanics of Solids	3
COE 362 or M 362K	Engineering Probability and Statistics or Probability I	3
Hours		15
Semester 2		
ASE 330M	Linear System Analysis	3
COE 321K	Computational Methods for Structural Analysis	3
COE 347	Introduction to Computational Fluid Dynamics	3
Technical Elective		3
<u>Humanities (040)</u>		3
Hours		15
Year 4		
Semester 1		
COE 374D	Computational Systems Senior Design I	3
ASE 375	Electromechanical Systems	3
Technical electives		3
<u>Visual and Performing Arts (050)</u>		3
<u>American and Texas Government (070)</u>		3
Hours		15
Semester 2		
COE 374E	Computational Systems Senior Design II	3
Technical electives		6
<u>U.S. History (060)</u>		3
Hours		12
Total Hours		122

Requirements

All requirements are listed below, starting with the most specialized moving to the most general. Additional requirements may follow the table, so be sure to read the entire page. Some required courses listed below may also satisfy [General Education](#) requirements, including [Core Curriculum](#).

Code	Title	Hours
Degree		
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	Topics in Advanced Scientific Computations	3

COE 374D	Computational Systems Senior Design I	3
COE 374E	Computational Systems Senior Design II	3
ASE 320	Low-Speed Aerodynamics	3
ASE 330M	Linear System Analysis	3
ASE 375	Electromechanical Systems	3
CH 301	Principles of Chemistry I	3
E M 306	Statics	3
E M 311M	Dynamics	3
E M 319	Mechanics of Solids	3
M 408C	Differential and Integral Calculus	4
M 408D	Sequences, Series, and Multivariable Calculus	4
M 427J	Differential Equations with Linear Algebra	4
M 427L	Advanced Calculus for Applications II	4
COE 362 or M 362K	Engineering Probability and Statistics Probability I	3
M E 210	Engineering Design Graphics	2
M E 310T	Applied Thermodynamics	3
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	3
PHY 303L	Engineering Physics II	3
Approved technical electives		12
E S 333T	Engineering Communication	3
RHE 306	Rhetoric and Writing	3
Free electives: Additional coursework to reach total hours required.		0
Subtotal		98
General Education		
Remaining Core Curriculum (42 hours total)		24
Foreign Language other than English, Beginning Proficiency		
Subtotal		24
College Requirements - Engineering		
General University Requirements		
Total Hours		122

Additional Requirements and Policies

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. Students 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](#).

Technical Electives

The technical electives allow students to focus in a specific area. Of the 12 hours in the degree plan, the following distribution is required. The course selections can vary based on the student's needs. A current list of approved electives is available on the department's website.

Code	Title	Hours
Math/Computational Elective		3
M 325K	Discrete Mathematics	
M 340L	Matrices and Matrix Calculations	
M 368K	Numerical Methods for Applications	

SDS 322E	Elements of Data Science
SDS 324E	Elements of Regression Analysis

Code	Title	Hours
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Foundational Elective		3
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ASE 362K	Compressible Flow
ASE 366K	Spacecraft Dynamics
ASE 479W	Aerial Robotics
M E 344	Dynamic Systems and Controls
RBT 350	Gateway to Robotics

Code	Title	Hours
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Advanced Elective or Math/Computational Elective		6
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COE 379L.1	Introduction to Machine Learning and Data Sciences
COE 379L.2	Simulation-based Aerodynamic Design and Analysis
COE 379L.3	Computational Methods
COE 379L.6	Software Design for Responsible Intelligent Systems
M 361K	Introduction to Real Analysis