Chemical Engineering

The George R. Brown School of Engineering

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

This major gives undergraduates a sound scientific and technical grounding for further development in a variety of professional environments. Courses in mathematics, chemistry, physics, and computational engineering provide the background for the chemical engineering core, which introduces students to chemical process fundamentals, fluid mechanics, heat and mass transfer, thermodynamics, kinetics, reactor design, process control, and process design. Course electives may be used to create a focus area in one of the following four disciplines: bioengineering, environmental engineering, materials science/engineering, and computational engineering. Upon completing either the flexible B.A. requirements or the more scientific and professional B.S.Ch.E. requirements, students may apply for a fifth year of study leading to the nonthesis Master of Chemical Engineering (M.Ch.E.) degree. A joint M.B.A./M.Ch.E. degree is also available in conjunction with the Jesse H. Jones Graduate School of Management.

Students admitted for graduate studies leading to the M.S. or Ph.D. degrees must complete a rigorous program combining advanced course work and original research that must be formalized in an approved thesis. Graduate research is possible in a number of areas, including thermodynamics, interfacial phenomena, complex fluids, polymer science and rheology, process control and optimization, reaction engineering and catalysis, reservoir engineering, biotechnology, and biomedical engineering.

Degree Requirements for B.A. and B.S. in Chemical Engineering

For general university requirements, see Graduation Requirements (pages 17–19). For the B.A. degree, students majoring in chemical engineering must complete 73 semester hours of departmental courses, which include prerequisites and laboratory courses. Students must have a minimum of 135 hours at graduation.
The B.S. Ch.E. degree is accredited by the Accreditation Board for Engineering and Technology (ABET). Through careful selection of other engineering and science courses, a student can develop a focus (or concentration) area in any of the following four engineering disciplines: environmental science/engineering, bioengineering, materials science/engineering, and computational engineering. These elective programs can be completed within the framework of a B.S. in chemical engineering and will be recognized as a separate item on a student’s transcript. Students majoring in chemical engineering must complete 100 hours in specified courses for a minimum of 135 hours at graduation. They must complete the following courses:

**Chemistry**

CHEM 151–152 Honors Chemistry with Laboratory  
(or CHEM 121–122 General Chemistry with Laboratory)  
CHEM 211–212 Organic Chemistry  
CHEM 213–214 Organic Chemistry Lab  
CHEM 311–312 Physical Chemistry  
Any 2 of CHEM 212, CHEM 311, or CHEM 312 are required for the B.S. degree.

**Chemical Engineering**

CENG 301 Chemical Engineering Fundamentals  
CENG 302 Separation Processes  
CENG 303 MATLAB and MAPLE for Chemical Engineers  
CENG 343 Chemical Engineering Lab I  
CENG 390 Kinetics and Reactor Design  
CENG 401 and 402 Transport Phenomena I and II  
CENG 403 Equipment Design  
CENG 404 Process Design  
CENG 411 and 412 Thermodynamics I and II  
CENG 443 and 444 Chemical Engineering Lab II and III (CENG 500 Undergraduate Research may be substituted for either CENG 443 or 444)  
CENG 470 Process Dynamics and Control  
CENG 471 Process Dynamics and Control Lab

**Mathematics**

MATH 101 and 102 Single Variable Calculus I and II  
MATH 211 Ordinary Differential Equations and Linear Algebra  
MATH 212 Multivariable Calculus (or equivalent honors courses)

**Computational and Applied Mathematics**

CAAM 210 or 211 Introduction to Engineering Computation (to satisfy computing requirements)  
CAAM 336 Differential Equations in Science and Engineering (or MATH 381 Introduction to Partial Differential Equations)

**Physics**

PHYS 101 or 111 Mechanics  
PHYS 102 or 112 Electricity and Magnetism

**Mechanical Engineering**

MECH 211 Engineering Mechanics

**Other Courses**

1 approved basic science course  
3 courses from the following:  
ELEC 243 Electrical Circuits  
MSCI 301 Materials Science  
CIVI 300 Mechanics of Solids  
ENVI 434 Chemical Transport and Fate in the Environment  
CENG 420 Biosystems Transport and Reaction Processes  
CENG 503 Chemical Engineering Processes: Air Pollution  
(or see requirements for focus areas in environmental science/engineering, bioengineering, materials science/engineering, and computational engineering)

The undergraduate curriculum is designed so that outstanding students interested in careers in research and teaching may enter graduate school after earning either bachelor’s degree.
Prerequisites for Chemical Engineering Courses. Before undergraduates may register for courses in chemical engineering at the 300 level and above, they must satisfy the following prerequisites:

For CENG 301
MATH 101 and 102
CHEM 151–152 (or 121–122)
Co-/Prerequisite: CENG 303

For CENG 302
CENG 301
Co-/Prerequisites: MATH 211 and 212 and CAAM 210 or 211

For CENG 390
CENG 301
MATH 211 and 212
Co-/Prerequisite: CENG 343

For CENG 401
PHYS 101 and 102
CENG 302

For CENG 402
CENG 401

For CENG 403
CENG 302, 390, 402, and 411
Co-/Prerequisites: CENG 470 and MECH 211

For CENG 404
CENG 403
Co-/Prerequisites: CENG 412 and 470

For CENG 411
CENG 302

For CENG 412
CENG 411

For CENG 470
CENG 390, 401, and 411

In unusual cases, and with the written consent of the instructor, students may register for a course without completing the required prerequisite(s). Waivers, however, are not transferable.

Degree Requirements for M.Ch.E., M.S., and Ph.D. in Chemical Engineering

For general university requirements, see Graduate Degrees (pages 72–73).

M.Ch.E. Program. For the M.Ch.E. degree, students must complete at least 30 hours of courses beyond those counted for their undergraduate degree. At least 6 of the courses taken must be upper-level courses in chemical engineering and 1 must be an approved mathematics course. The chemical engineering courses selected should include process design (2 semesters) and process control, unless courses in these subjects were taken during the student’s undergraduate studies.

M.S. Program. Candidates for the M.S. degree must:
• Complete at least 18 approved semester hours with high standing
• Submit an original research thesis
• Defend the thesis in a public oral examination

Ph.D. Program. Candidates for the Ph.D. degree must:
• Demonstrate competence in the areas of applied mathematics, thermodynamics, transport processes, and chemical kinetics and reactor design by passing qualifying examinations, usually during the first year of study
• Complete at least 36 approved semester hours with high standing (with department approval, the course requirements may be reduced to 24 hours for students already holding an M.S. degree)
• Submit a thesis that provides evidence of their ability to carry out original research in a specialized area of chemical engineering
• Defend the thesis in a public oral examination

See CENG (pages 279–282) in the Courses of Instruction section.