

# 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.S. in Chemical Engineering

For general university requirements, see Graduation Requirements (pages 20–23). The B.S. 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 4 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. Students majoring in chemical engineering must complete 96 hours in specified courses for a minimum of 132 hours at graduation. They must complete the following courses.

### Chemistry

CHEM 121/122 *General Chemistry with Laboratory*  
 or CHEM 151/152 *Honors Chemistry with Laboratory*  
 CHEM 211/212 *Organic Chemistry*  
 CHEM 217 *Organic Chemistry Lab*  
 CHEM 311/312 *Physical Chemistry*  
 Any 2 of CHEM 212, CHEM 311, or CHEM 312

### Chemical Engineering

CENG 301 *Chemical Engineering Fundamentals*  
 CENG 303 *MATLAB, FORTRAN and MAPLE for Chemical Engineers*  
 CENG 305 *Computational Methods for Chemical Engineers*  
 CENG 343 *Chemical Engineering Lab I*  
 CENG 390 *Kinetics and Reactor Design*  
 CENG 401/402 *Transport Phenomena I and II*  
 CENG 403 *Equipment Design*  
 CENG 404 *Process Design*  
 CENG 411/412 *Thermodynamics I and II*  
 CENG 443 *Chemical Engineering Lab II*  
 CENG 470 *Process Dynamics and Control*

### Mathematics

MATH 101/102 *Single Variable Calculus I and II*  
 MATH 211 *Ordinary Differential Equations and Linear Algebra*

MATH 212 *Multivariable Calculus* or equivalent honors courses  
 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*  
 CEVE 300 *Mechanics of Solids*  
 CEVE 434 *Chemical Transport and Fate in the Environment*  
 BIOE 420 *Biosystems Transport and Reaction Processes*  
 BIOE 460 *Biotechnological Processes*  
 CEVE 411 *Air Resource Management*  
 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.

## Degree Requirements for B.A. in Chemical Engineering

Students pursuing the B.A. degree in chemical engineering must meet all of the requirements for the B.S.Ch.E. degree except for the following courses: CENG 404 and CENG 470, the additional “basic science” course, and the 3 “other engineering” courses. Free electives may be substituted for these 6 courses to reach at least 132 semester hours for graduation.

**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 101/102  
CHEM 121/122 or CHEM 151/152  
Corequisite: CENG 303

### For CENG 403

CENG 390, 402, and 412  
Co/Prerequisites: CENG 470 and MECH 211

### For CENG 390

CENG 301, 303, and 305  
MATH 211/212

### For CENG 404

CENG 403

### For CENG 401

CENG 411  
MATH 211/212  
PHYS 101/102  
Co/Prerequisite: CENG 305

### For CENG 411

CENG 301 and 303

### For CENG 412

CENG 411

### For CENG 402

CENG 401  
Co/Prerequisites: CAAM 336 or MATH 381

### For CENG 470

CENG 390, 402, and 412

With the written consent of the instructor, students may register for a course without completing the required prerequisite(s). Waivers, however, are not transferrable.

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

For general university requirements, see Graduate Degrees (pages 65–70).

**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 (two 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 in the Courses of Instruction section.**