CHEMICAL ENGINEERING, BSCHE

Chemical engineering students have strong interests in math, chemistry, physics, and biology. These subjects are often combined and encountered throughout our curriculum. Overall, chemical engineering students are curious about how and why things work, and they have a desire to invent new ways to improve existing technology.

The BSChE degree is a professional degree that prepares graduates for employment and graduate study in chemical engineering and related fields, as well as entry into professional programs such as medicine, dentistry, law, and business.

Chemical engineers apply economics, chemistry, biology, physics, and mathematics to the design and operation of processes and to the research and development of new materials, processes, and systems. The many and varied issues associated with going from concept to demonstration to operation of processes and equipment all fall within the province of chemical engineering. Chemical engineers are as comfortable with plant operations, research and development projects, synthesis of alternative fuels, energy conservation and conversion, process design, optimization and control, environmental conservation and pollution prevention, as they are with the exciting fundamental studies associated with biotechnology, nanotechnology, electrochemical technology, and other areas yet to be discovered.

The BSChE degree and curriculum place strong emphasis on the basic sciences, but a vital feature remains the high degree of confidence and practical ability gained from laboratory and design courses. Laboratories include equipment needed to study and demonstrate heat, mass, and momentum transfer; material and energy balances; process dynamics and control; chemical reaction systems, and thermodynamics. The laboratory courses cover fundamental principles to reinforce the basic courses within the chemical engineering curriculum, while also containing pilot scale process units and other pieces of equipment that allow students to build, operate, and analyze results collected during their operation. The Chemical and Biological Engineering High Bay Facility provides state-of-the-art visualization equipment for research and instruction in continuous and batch distillation and reaction engineering. Individual faculty member research laboratories give students the opportunity to work one-on-one with faculty in special problems courses.

The Chemical and Biological Engineering Design component of this curriculum includes development of student creativity, use of open-ended problems, development and use of modern design theory and methodology, formulation of design problem statements and specifications, consideration of alternative solutions, feasibility analyses, concurrent engineering design, technical research, and detailed system descriptions. The introduction of realistic constraints, such as economic factors, safety, reliability, aesthetics, ethics and environmental and social impacts, are used to fully develop each design experience.

Program Objectives

Within a few years of graduation, UA chemical engineering graduates will be able to:

- Provide solution strategies for a wide variety of technical applications, including the design and improvement of chemical or biological processes
- Successfully pursue their desired career path while upholding ethical, safe, and environmentally-responsible strategies that benefit society
- Continue to grow professionally and advance in their respective careers by utilizing effective communication skills, by working successfully as a member of a professional team, and by expanding their knowledge and application of chemical and biological engineering

Student Outcomes

Student learning outcomes include the following:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics

2. 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

3. an ability to communicate effectively with a range of audiences

4. 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

5. 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

6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions

7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

Special Features

While the baccalaureate degree curriculum contains many courses designed to sequentially introduce students to methodologies for understanding, defining, and solving a broad array of increasingly complex problems, there are elements in the program that also allow students to investigate exciting and challenging issues that often exist at the intersections where engineering and the sciences meet. Some of the elective and special program options are described below.

Chemical Engineering Curriculum

Elective Courses and Minors

Students can explore other areas of personal interest through six hours of career electives as part of the curriculum. Six hours of credit must be selected to fulfill the career electives requirements of the curriculum. This provides students with an option to add breadth to their degree in preparation for the wide variety of careers that chemical engineers pursue after completing the B.S. degree. A student may also select courses through a chemical engineering elective course, an advanced science elective, a biochemistry elective and an engineering elective. Many of these elective courses can be used as part of obtaining a minor or certificate along with a B.S. degree in chemical engineering.

Undergraduate Research

Many students elect to take special problems (undergraduate research) to gain valuable hands-on experience in laboratory or computational settings with a faculty member in ChBE or related disciplines. These courses may be used to satisfy elective course requirements when they are designed to meet the requirements of those course blocks. Products from this activity often include opportunities for making presentations at local and national meetings, co-authoring technical papers or travel. This

kind of activity is particularly helpful to students who wish to pursue an advanced degree in chemical engineering or related fields.

International Opportunities

Study abroad programs enhance the undergraduate experience. While there are many opportunities to participate in international classes, some specific programs for chemical engineering students in recent years have included summer lab (ChE 323) in Denmark or Scotland, and an international exchange with University College Dublin in Ireland. Students should check the engineering website and UA's Study Abroad office for updated opportunities.

Accelerated Masters Program

Administered by the University's Graduate School, this program allows eligible students to prepare for advanced study by enrolling in courses that can concurrently satisfy bachelor of science (B.S.) and master of science (M.S.) degree requirements. Enrollment typically is prior to the start of the junior year. The eligibility requirements may be found in the Special Academic Programs section of this catalog. A PhD accelerated program began in 2015 that allows students to combine their B.S with a PhD in Chemical Engineering.

Dual Chemical Engineering/Chemistry Major

UA's Department of Chemical and Biological Engineering and Department of Chemistry offer a dual major program allowing undergraduate students to obtain a single B.S. degree in chemical engineering with both chemistry and chemical engineering listed as majors. The dual major combines core coursework for both chemical engineering and chemistry majors. Career and advanced science elective slots in the chemical engineering curriculum are satisfied by courses in Chemical Equilibria and Analyses, covering classical methods of quantitative and analysis including a laboratory introduction to spectroscopic and chromatographic methods, and Physical Chemistry with Elementary Physical Chemistry Laboratory, while the biology elective slot is fulfilled with Biochemistry I. In addition, Organic Chemistry Laboratory II and a 400 level chemistry elective course are required for a total of four additional hours beyond the chemical engineering degree requirement. Alternatively, students can pursue double majors, resulting in two degrees. A double major requires a completion of both degree programs (B.S. ChE and B.S. Chemistry, for example), and a minimum of 150 course credits at graduation.

Pre-medical/Pre-dental/Pre-law Options

The baccalaureate degree is a popular study plan for preparation to enter one of the professional programs listed. Acceptance rates for our students are excellent and the preparation that an engineering degree provides makes these tracks desired ones.

The general academic policies for the College of Engineering can be found here***.***

Chemical Engineering Curriculum

Freshman			
Fall	**Hours**	**Spring**	**Hours**
CH 101 or 117	4	BSC 114 or 118	3
EN 101	3	CH 102 or 118	4
CHE 125	1	EN 102	3
MATH 125 or 145	4	MATH 126 or 146	4
ENGR 103 or 123	3	History (HI) or Social and Behavioral Sciences (SB) Elective[1]	3
	15		**17**

Sophomore			
Fall	**Hours**	**Spring**	**Hours**
CH 231	3	CH 232	3
CHE 254	4	CH 237	2
MATH 227 or 247	4	CHE 255	4
PH 105	4	MATH 238	3
		PH 106	4
	15		**16**

Junior					
Fall	**Hours**	**Spring**	**Hours**	**Summer**	**Hours**
CHE 304	3	CHE 305	3	CHE 323[3]	4
CHE 306	3	CHE 324	3		
Engineering Elective (see advisor)	3	CHE 354	3		
History (HI) or Social and Behavioral Sciences (SB) Elective[1]	3	Career Elective (see advisor)	3		
Humanities (HU), Literature (L), Fine Arts (FA) Elective	3	History (HI) or Social and Behavioral Sciences (SB) Elective[1]	3		
	15		**15**		**4**

Senior			
Fall	**Hours**	**Spring**	**Hours**
CHE 481	3	CHE 482	3
CHE 493	3	Biochem Elective (see advisor)	3
Chemical Engineering Elective (see advisor)	3	Career Elective (see advisor)	3
Humanities (HU), Literature (L), or Fine Arts (FA) Elective	3	Humanities (HU), Literature (L), or Fine Arts (FA) Elective	3
Advanced Science Elective (see advisor)	3	CHE 440, 441, or 540[2]	3
	15		**15**

Total Hours: 127

Footnotes

1 EC 110 Principles of Microeconomics is a recommended SB course.

2 Students in Accelerated Masters Program and graduate students may enroll in 500-level courses

[3] CHE 323 Operations Laboratory can be replaced by taking both academic year labs: CHE 321 Basic CHE Lab and CHE 322 Unit Operations Laboratory,

Dual BS CHE/CH Degree Curriculum

The College of Engineering enforces a C- or higher requirement for any courses that are a prerequisite for another required course.

Freshman

Fall	Hours	Spring	Hours
CH 101 or 117	0-4	BSC 114 or 118	3
CHE 125[1]	1	CH 102 or 118	0-4
EN 101	3	EN 102	3
MATH 125 or 145	0-4	MATH 126 or 146	4
ENGR 103	3	History (HI) or Social and Behavioral Sciences (SB) Elective[1]	3
	7-15		**13-17**

Sophomore

Fall	Hours	Spring	Hours
CH 231	3	CH 232	3
CHE 254	4	CH 237	0 or 2
MATH 227 or 247	4	CH 223	0 or 4
PH 105 or 125	0-4	CHE 255	4
History (HI) or Social and Behavioral Sciences (SB) Elective[1]	3	MATH 238	3
	14-18		**10-16**

Junior

Fall	Hours	Spring	Hours	Summer	Hours
CH 338	0 or 2	CHE 305	3	CHE 323[3]	4
CHE 304	3	CHE 324	3		
CHE 306	3	CHE 354	3		
PH 106 or 126	0-4	Humanities (HU), Literature (L), or Fine Arts (FA) Elective	3		
Humanities (HU), Literature (L), or Fine Arts (FA) Elective	3	Humanities (HU), Literature (L), or Fine Arts (FA) Elective	3		
	9-15		**15**		**4**

Senior

Fall	Hours	Spring	Hours
CHE 481	3	CHE 482	3
CHE 493	3	CH Elective	3
Chemical Engr. Elective (see advisor)	3	CHE 440, 441, or 540[2]	3
CH 441	3	Engineering Elective (see advisor)	3
CH 343	1	History (HI) or Social and Behavioral Sciences (SB) Elective	3
CH 461	3		
	16		**15**

Total Hours: 103-131

Footnotes

[1] EC 110 Principles of Microeconomics is a recommended SB course.

[2] Students enrolled in Accelerated Masters Program and graduate students may enroll in 500-level courses.

[3] CHE 323 Operations Laboratory can be replaced by Academic Year Labs CHE 321 and CHE 322.

Biological Engineering Concentration

1. Students must complete a minimum of 15 credit hours from the approved courses list (below)

2. Students must be Chemical Engineering majors to receive credit for the concentration

Required course - must complete one of the following. If a student selects CH 461 or BSC 450 for the biochemistry requirement, they cannot count the other course, but may count CHE 445/446 as an elective course.

Code and Title		Hours
CHE 445 or CHE 446	Intro to Biochemical Engr Honors Intro to Biochem Eng	3
CH 461	Biochemistry I	3
BSC 450	Fundamentals of Biochemistry	3

Electives - must complete 12 hours from the list below.

Code and Title		Hours
CHE 418 or CHE 419	Tissue Engineering Honors Tissue Engineering	3
CHE 492	Special Topics (Stem Cell Engineering AND/OR Microbial Engineering)	3
BSC 300	Cell Biology	0 or 3
BSC 310	Microbiology	3
BSC 312	Microbiology Lab	2
BSC 315	Genetics	3
BSC 385	Ecology and Evolution	3
BSC 424	Human Physiology	3
BSC 425	Human Physiology Lab	2
BSC 435	Immunology	4
BSC 441	Developmental Biology	3
BSC 442	Integrated Genomics	4
BSC 444	General Virology	3
BSC 449	Endocrinology	3
BSC 451	Molecular Biology	3

BSC 465	Prin Of Toxicology	3
PH 411	Biophysics	3

Students find careers in the following industries: petroleum, plastics, pulp and paper, food, consumer products, biotechnology, fine chemicals, pharmaceuticals, medical, environmental

Types of Jobs Accepted

Our chemical engineering students are in high demand and find jobs with local industries within the state, as well as with Fortune 500 companies around the globe. Common employers are power companies, engineering design firms, large chemical manufacturers, and petroleum refiners.

Jobs of Experienced Alumni

Our experienced alumni have become leaders in major industries, consulting firms, the medical field, and academic institutions. We have had alumni obtain positions as faculty at MIT and as CEOs at Fortune 500 companies, and become prominent judges. Many of our alumni stay connected with our department, including service on our Advisory Board.

Learn more about opportunities in this field at the Career Center