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Department of Chemical and Biochemical Engineering

chemeng.mst.edu

B.S. Degree in Chemical Engineering with an Emphasis in Biochemical Engineering

Biochemical engineering is the branch of engineering which deals with changing the composition, energy content, and state of aggregation of biological materials. As a chemical engineering student, you will consider the fundamental properties and nature of matter (chemistry), the forces that act on matter (physics), the precise expressions of the relationships between them (mathematics) and the application to living systems (biology). Biochemical engineers take chemistry and microbiology out of the laboratory and into the world around us. They are creative problem solvers who apply scientific knowledge and technical expertise to make useful materials at a reasonable cost and in the safest manner possible. Computers are used extensively in solving engineering problems in the biotechnology field.

Biochemical engineers are involved in creating new wonder drugs and materials that improve life on earth. They develop processes to turn agricultural products into useful substances such as drugs, vitamins, proteins, and oils. They use biochemical and biological methods to improve the environment.

At Missouri S&T, biochemical engineering is an emphasis program in the department of chemical engineering. Your studies will give you a broad technical basis with an emphasis on material balances, energy balances, separation processes, rate processes, unit operations, process economics and design. In the biochemical engineering emphasis program you will gain experience in biochemistry, biotechnology, microbiology, molecular biology, the separation and purification of biological substances and biochemical reactor design.

In the biochemical emphasis program you will be prepared to work in the biotechnology industry and to pursue graduate degrees in biochemical engineering or medicine. Graduates have skills that make them attractive to industries such as pharmaceutical companies, manufacturers of specialty products from agricultural feedstock, biotechnology companies, and environmental consultants. Since the program is built upon the basis of a strong, traditional chemical engineering program, graduates of this emphasis program also often seek jobs in other chemical industries.

You will have laboratories which offer training in qualitative and quantitative analysis, organic and physical chemistry, physics, unit operations, protein separation and purification, biochemical reactor design, process control, instrumentation, and design.

Faculty

The chemical engineering department has 16 full-time faculty members and 9 adjunct faculties. Typical class size is 35-45 students.

Professional and Service Organizations

There is a very active student chapter of the American Institute of Chemical Engineers (AIChE). The AIChE Student Chapter brings practicing chemical engineers to their meetings to describe their responsibilities and opportunities at their company. Students in the department also participate in Omega Chi Epsilon, the national chemical engineering honor society; Tau Beta Pi, the engineering honor society; and Alpha Chi Sigma, a service society for students in chemistry-related fields.

Experiential Learning

Cooperative Education (Co-Op) is a structured educational strategy that alternates semesters of classroom studies with learning through productive work experiences at an industrial facility. It provides progressive experiences in integrating theory and practice. The Missouri S&T Career Opportunity and Employer Relation Guide (COER) has numerous contacts for students seeking a co-op along with many companies that come to campus to recruit co-op students.

There are numerous opportunities for undergraduate students to become involved in

research. Many of the current research projects involve faculty members from multiple departments working on a team. This provides undergraduates an excellent opportunity to do research in a variety of areas while pursuing a degree in chemical engineering. The Missouri S&T's Opportunity for Undergraduate Research Experience (OURE) program provides a stipend to allow undergraduates to work with a professor for an academic year. Students can choose to fulfill one of their technical electives with ChemEng 4099 (UG Research) where they work on a project with a faculty member for credit.

Students who participate in undergraduate research often present their results at the AIChE regional and national conferences and at a Missouri S&T sponsored conference that occurs each spring. The Missouri S&T AIChE student chapter is very active and helps to provide funds for students to present their results at these conferences.

Three of the Missouri S&T design teams are of interest to biochemical engineers: iGEM, Chem-E-Car and Chem-E-Cube. iGEM has students use genetic engineering to solve a real-world problem. Chem-E-Car requires students to build a shoe-box sized car that is powered by and stops using chemical reactions (and no brakes!). The students build batteries, research other power sources, and carefully calibrate their chemical reactions for these competitions. The Chem-E-Cube team builds a chemical plant that will fit inside a 1 ft³ space and meet the goals for that year's competition. These design teams work with the Student Design and Experiential Learning Center (SDELC) and the department to safely build and test their equipment.

Course Plan for B.S. in Chemical Engineering with Biochemical Emphasis

Freshman Year

First Semester		Credits
FR ENG 1100	Study & Careers in Engineering	1
CHEM 1100	Lab Safety	1
CHEM 1310	General Chemistry I Lecture	4
CHEM 1319	General Chemistry I Lab	1
ENGLISH 1120	Exposition & Argumentation	3
HIST 1200, 1300, 1310, or POL SCI 1200		3
MATH 1214 or 1211	Calculus I or I-B	4
Total		17
Second Semester		
MECH ENG 1720	Intro to Engineering Design	3
COMP SCI 1500		3
CHEM 1320	General Chemistry II Lecture	3
MATH 1215	Calculus II	4
PHYSICS 1135	Engineering Physics I	4
Total		17

Sophomore Year

First Semester		Credits
CHEM ENG 2100	Material I & Energy Balances	4
CHEM 2210	Organic Chemistry I Lecture	3
MATH 2222	Calculus III	4
PHYSICS 2135	Engineering Physics II	4
Total		15
Second Semester		
CHEM ENG 2110	Thermodynamics I	3
ENGLISH 3560	Technical Writing	3
MATH 3304	Differential Equations	3
Science Elective (Lecture)		3
Science Elective (Lab)		1
STAT 3113	Applied Engineering Statistics	3
Total		16

Junior Year

First Semester		Credits
CHEM ENG 3101	Transport	4
CHEM ENG 3111	Numerical Computing	3
CHEM ENG 3120	Thermodynamics II	3
SP&M S 1185	Principles of Speech	3
Science Elective (Lecture)		3
Science Elective (Lab)		1
Total		17
Second Semester		
CHEM ENG 3131	Separations	3
CHEM ENG 3141	Process Operations	3
CHEM ENG 3150	Reactor Design	3
General Education Elective		3
Science Elective (Lecture)		3
Science Elective (Lab)		1
Total		16

Senior Year

First Semester		Credits
CHEM ENG 4091	Chemical Process Design I	3
CHEM ENG 4201	Biochem Separations Lab (Fall Only)	3
CHEM ENG 4210	Biochem Reactors (Fall Only)	3
CHEM ENG 4241	Process Safety	3
CHEM ENG 4301	Materials (CHEM ENG 2300)	1
General Education Elective		3
Total		16
Second Semester		
CHEM ENG 4097	Chemical Process Design II	3
CHEM ENG 4110	ChE Process Dynamics & Control	3
CHEM ENG 4210	Biochem Reactors Lab (Spring Only)	3
CHEM ENG 4311	Ethics (CHEM ENG 2310) (Spring Only)	1
CHEM ENG 5250	Isolation & Purification (Spring Only)	3
General Education Elective		3
Total		16