

# Dave C. Swalm School of Chemical Engineering

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## Chemical Engineering

Chemical Engineering is a profession where a diverse group of individuals contribute to the invention, development, and deployment of an incredible range of processes and products in a variety of industries including chemical, petrochemical, environmental, pharmaceutical, environmental, and materials. Chemical engineering is the branch of engineering that deals with the chemical and physical processes used to develop and manufacture many different products of greater value from lesser valued chemicals and feedstocks. Without question, chemical engineers are making major contributions to the technological infrastructure of modern society.

The mission of the Swalm School of Chemical Engineering is to produce graduates who have the ability to apply the principles of the physical sciences, together with the principles of economics and human relations, to fields that pertain directly to processes and process equipment that treat material to effect a change in state, energy content, or composition.

Graduates will receive a broad education that will enable them to become leaders in industry, the profession, and the community. Those graduates who excel academically will be prepared for entry to graduate or professional school.

To achieve our mission, Program Educational Objectives have been established to help us assess the degree to which we have achieved these objectives.

## Program Educational Objectives

Mississippi State University Chemical Engineering graduates will:

1. Successfully work in the chemical engineering profession as design, process, and research engineers (and related designations) with prominent companies in chemical process, petroleum and petro-chemical, environmental, government agencies, consulting, or other, related industries.
2. Demonstrate an ability to address unstructured problems specific to chemical engineering technical specialties by identifying and implementing solutions using the proper tools, practical approaches, addressing health safety and environmental issues, and flexible thinking.
3. Be involved in professional development that may include pursuit of post-baccalaureate degrees in chemical engineering and related fields, business and professional programs including medicine and law -- advancing in their chosen fields to technical leadership, supervisory and management roles and by obtaining professional licensure where appropriate.

Students choosing to major in Chemical Engineering will select one of three concentration areas within the Chemical Engineering Program:

1. Chemical Engineering Practice Concentration;
2. Chemical Engineering Research/Development Concentration; or
3. Biomolecular Engineering Concentration.

**Chemical Engineering Practice Concentration.** This concentration area prepares the graduate to enter industry upon graduation well-prepared to function as a chemical engineer, in a variety of industries as well as in a variety of job functions. Students pursuing this option are also well prepared for graduate studies in chemical engineering or professional school. A combination of 12 hours of technical electives, chemical engineering elective, and chemistry elective allows a student to emphasize an area of interest, including materials, environmental, energy (including alternative energy), or traditional chemical engineering.

**Chemical Engineering Research/Development Concentration.** This concentration area prepares the chemical engineering graduate for further educational endeavors at the graduate level and for opportunities in research and development by providing them with additional training in mathematics and chemical engineering topics. Focused selection of technical, chemistry, and basic engineering electives provides the opportunity to develop the depth required for post-graduate research activities in chemical engineering.

**Biomolecular Engineering Concentration.** This concentration area prepares the graduate for a career in the biotechnology industry. The concentration area also provides students the opportunity to fulfill prerequisites for medical, dental, or veterinary school upon completion of their chemical engineering degree. Focused selection of technical, chemistry, and basic engineering electives provides the opportunity to develop the depth required in biology, biochemistry, and microbiology for students interested in this concentration. While students regularly enter medical school via the Chemical Engineering Practice concentration, the biomolecular engineering concentration offers students not only a bachelor's degree in chemical engineering, but also highlights those topics encountered in biotechnology, medical school or in veterinary school.

The Chemical Engineering program is accredited by the Engineering Accreditation Commission of ABET, <http://www.abet.org>.

## Petroleum Engineering

This curriculum is designed to educate students on the foundational principles required for success in the petroleum industry. Graduates will be prepared to enter the workforce and manage the human and energy resources in the petroleum industry. Students will develop hands-on, communication, and critical thinking skills to be successful. The program offers unique training with a particular emphasis on petroleum reservoir engineering, enhanced petroleum recovery methods, and thorough economic analysis. The degree is housed within the Swalm School of Chemical Engineering, and offers a student-focused curriculum with one-on-one advising and professional development opportunities.

The petroleum industry is one of the world's largest industries and is relied upon for our current way of life in several ways. First, petroleum fuels can be burned for energy which is used to supply heat and generate electricity for stationary applications. Secondly, petroleum has a favorable energy density and can be pursued for transportation applications. Finally, petroleum products are used to produce many chemical products of industrial and household relevance. The world consumes over 30 billion barrels of oil per year. It is estimated that 25% of the oil produced annually is used in the United States of America. The state of Mississippi ranks 13th in annual petroleum production in the United States. Major refineries in the state are located in Pascagoula, Vicksburg, and Sandersville. The state is estimated to produce 3.1% of U.S. motor gasoline and 1.7% of U.S. distillate fuel, which are significant amounts given the total volume of consumption.

### Program Educational Objectives

Mississippi State University Petroleum Engineering graduates will:

1. Obtain gainful employment and hold positions of increasing responsibility in the field of Petroleum Engineering as a Reservoir, Production or Drilling engineer
2. Apply effective communications, leadership and teaming skills in the field of petroleum engineering in industry, academia or government.
3. Continue to improve technical skills through continued education, professional licensure, Certifications etc.

## Chemical Engineering

### General Education and Degree Requirements

#### English Composition

EN 1103	English Composition I	3
or EN 1163	Accelerated Composition I	
EN 1113	English Composition II	3
or EN 1173	Accelerated Composition II	

#### Mathematics

See Major Core

#### Science

See Major Core

#### Humanities

See General Education courses 6

#### Fine Arts

See General Education courses 3

#### Social/Behavioral Sciences

See General Education courses 6

#### Major Core

**Math and Basic Science 36**

MA 1713	Calculus I	
MA 1723	Calculus II	
MA 2733	Calculus III	
MA 2743	Calculus IV	
MA 3253	Differential Equations I	
CH 1213	Chemistry I	
CH 1211	Investigations in Chemistry I	
CH 1223	Chemistry II	
CH 1221	Investigations in Chemistry II	
CH 4511	Organic Chemistry Laboratory I	
CH 4513	Organic Chemistry I	
CH 4523	Organic Chemistry II	

PH 2213	Physics I	
PH 2223	Physics II (or accepted substitutions)	
<b>Engineering Topics</b>		<b>49</b>
CHE 1101	Introduction to Chemical & Petroleum Engineering	
CHE 2114	Mass and Energy Balances	
CHE 2213	Chemical Engineering Analysis	
CHE 3113	Chemical Engineering Thermodynamics I <sup>1</sup>	
CHE 3123	Chemical Engineering Thermodynamics II	
CHE 3203	Fluid Flow Operations <sup>1</sup>	
CHE 3213	Heat Transfer Operations <sup>1</sup>	
CHE 3222	Chemical Engineering Laboratory I	
CHE 3223	Separation Processes	
CHE 3232	Chemical Engineering Laboratory II	
CHE 3413	Engineering Materials	
CHE 4113	Chemical Reactor Design	
CHE 4134	Process Design	
CHE 4223	Process Instrumentation and Control	
CHE 4233	Chemical Plant Design	
CHE 4633	Chemical Process Safety	
IE 3913	Engineering Economy I	
<b>Oral Communication Requirement</b>		
Fulfilled in CHE 3222, CHE 3232, CHE 4134 and CHE 4233		
<b>Writing Requirement</b>		
GE 3513	Technical Writing	<b>3</b>
<b>Computer Literacy</b>		
Fulfilled in CHE 2213 and CHE 4134		
<b>Choose one of the following sets of courses to complete the degree:</b>		<b>19</b>
<b>Chemical Engineering Practice Concentration (CHEP)</b>		
EM 2413	Engineering Mechanics I	
or ECE 3183	Electrical Engineering Systems	
CHE 3331	Professional Development Seminar	
CH 4413	Thermodynamics and Kinetics	
Chemical Engineering Elective <sup>2</sup>		
Chemistry Elective <sup>3</sup>		
Technical Electives <sup>3</sup>		
(It is strongly recommended that CHE 4313 Transport Phenomena be used as a technical elective)		
<b>Chemical Engineering Research/Development Concentration (CERD)</b>		
CHE 4313	Transport Phenomena	
CHE 3331	Professional Development Seminar	
MA 3113	Introduction to Linear Algebra	
MA 3353	Differential Equations II	
MA /ST 4543	Introduction to Mathematical Statistics I (MA/ST 4543 is a cross-listed course, but the student should choose MA 4543 if a minor in mathematics is desired.)	
or IE 4613	Engineering Statistics I	
CH 4413	Thermodynamics and Kinetics	
Chemistry Elective <sup>3</sup>		
<b>Biomolecular Engineering Concentration (BIOM)</b>		
BIO 1134	Biology I	
BIO 1144	Biology II	
BIO 3304	General Microbiology	
BCH 4603	General Biochemistry	
CH 4521	Organic Chemistry Laboratory II	

Choose one of the following:

PH 2233	Physics III (pre-medical students)	
	Advanced biology course (pre-veterinary students)	
	Biotechnology course from an engineering dept. (Biomolecular engineering practice)	

**Total Hours** 128

- 1 With consent of student's advisor, the following course substitutions are acceptable:
  - EM 3313 Fluid Mechanics for CHE 3203
  - ME 3513 Thermodynamics I for CHE 3113
  - ME 3313 Heat Transfer for CHE 3213
- 2 CHE 4000 Directed Individual Study will generally be disallowed for the required chemical engineering elective but may be used as a technical elective.
- 3 The Chemistry and Technical Electives are to be chosen from an approved list available online and from the student's advisor.

## Petroleum Engineering

### General Education and Degree Requirements

#### English Composition

EN 1103	English Composition I	3
EN 1113	English Composition II	3

#### Mathematics (see Major core)

#### Science (see Major core)

**Humanities (see General Education list)** 6

**Fine Arts (see General Education list)** 3

**Social/Behavioral Sciences (see General Education list)** 6

#### Major Core-Math and Basic Science

MA 1713	Calculus I	3
MA 1723	Calculus II	3
MA 2733	Calculus III	3
MA 2743	Calculus IV	3
CH 1211	Investigations in Chemistry I	1
CH 1213	Chemistry I	3
CH 1221	Investigations in Chemistry II	1
CH 1223	Chemistry II	3
GG 1113	Survey of Earth Sciences I	3
PH 2213	Physics I	3
PH 2223	Physics II	3

Choose at least one of the following: 3-4

GG 4063	Development of Fossil Fuel Resources	
GG 4153	Engineering Geology	
GG 4304	Principles of Sedimentary Deposits I	
GG 4413	Structural Geology	
GG 4443	Principles of Sedimentary Deposits II	

#### Major Core - Engineering Topics

CHE 1101	Introduction to Chemical & Petroleum Engineering	1
CHE 2114	Mass and Energy Balances	4
CHE 2213	Chemical Engineering Analysis	3
CHE 3113	Chemical Engineering Thermodynamics I	3
CHE 3413	Engineering Materials	3
CHE 4313	Transport Phenomena	3
EM 2413	Engineering Mechanics I	3
EM 3213	Mechanics of Materials	3
IE 3913	Engineering Economy I	3

IE 4613	Engineering Statistics I	3
PTE 3902	Petroleum Engineering Lab 1	2
PTE 3903	Petroleum Reservoir Fluid Properties	3
PTE 3912	Petroleum Engineering Lab 2	2
PTE 3953	Petroleum Reservoir Rock Properties and Fluid Flow	3
PTE 3963	Drilling	3
PTE 3973	Petroleum Production Operations	3
PTE 4903	Petroleum Reservoir Engineering 1	3
PTE 4913	Petroleum Reservoir Engineering 2	3
PTE 4923	Completion Design	3
PTE 4953	Formation Evaluation	3
PTE 4963	Oil Recovery Methods	3
PTE 4993	Petroleum Economic Analysis	3
<b>Writing Requirement</b>		
GE 3513	Technical Writing	3
<b>Oral Communication Requirement - Fulfilled in PTE 3902, PTE 3912, and PTE 4993</b>		
<b>Computer Literacy - Fulfilled in CHE 2213 and PTE 4993</b>		
<b>Technical Electives</b>		<b>6</b>
<b>Total Hours</b>		<b>128</b>