

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.

Chemical Engineering

Program Educational Objectives

Mississippi State University Chemical Engineering graduates will:

- a. Successfully enter the chemical engineering profession as design, process and research engineers (and related designations) with prominent companies in the chemical process industries, energy, environmental, government agencies, consulting or other related industries.
- b. Apply communication and engineering technical skills to the field of chemical engineering to enhance economic development and address technical issues facing industry, academia and the government.
- c. Pursue post-baccalaureate degrees in chemical engineering and related fields, business and professional programs including medicine and law.
- d. Demonstrate proficiency in chemical engineering practice and leadership development by advancing in their chosen fields to technical leadership, supervisory and management positions.
- e. Enter their chosen fields maintaining the highest degree of ethical conduct and safety responsibility.

Concentrations

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

- a. Chemical Engineering Practice Concentration;
- b. Chemical Engineering Research/Development Concentration; or
- c. 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 B. S. program in Chemical Engineering is accredited by the Engineering Accreditation Commission of ABET, <https://www.abet.org>, under the commission's General Criteria and Program Criteria for Chemical, Biochemical, Biomolecular, and similarly named engineering programs.

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 in numerous ways for sustaining a modern and ever-advancing energy-driven, technologically-based society.

Petroleum Engineering

Program Educational Objectives

Mississippi State University Petroleum Engineering graduates will:

- Obtain gainful employment and hold positions of increasing responsibility in the field of Petroleum Engineering as a Reservoir, Production, Data Analytics, Drilling, or Field Engineer.
- Apply effective communications, leadership, and teaming skills in the field of petroleum engineering in industry, academia or government.
- Demonstrate continuing improvements in technical skills through professional development and training, professional licensure, or appropriate certification.

The B. S. program in Petroleum Engineering is accredited by the Engineering Accreditation Commission of ABET, <https://www.abet.org>, under the commission's General Criteria and Program Criteria for Petroleum and similarly named engineering programs.

Chemical Engineering

General Education and Degree Requirements

English Composition

| | | |
|-----------------------|---|---|
| EN 1103 or EN 1104 | English Composition I Expanded English Composition I | 3 |
| EN 1113 or EN 1173 | English Composition II Accelerated Composition II | 3 |

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 | |

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|--|--|-----------|
| CH 4523 | Organic Chemistry II | |
| PH 2213 | Physics I | |
| PH 2223 | Physics II (or accepted substitutions) | |
| Engineering Topics | | 49 |
| CHE 1101 | Introduction to Chemical & Petroleum Engineering | |
| CHE 2114 | Mass and Energy Balances | |
| CHE 2213 | Chemical Engineering Analysis | |
| CHE 3113 | Chemical Engineering Thermodynamics I ¹ | |
| CHE 3123 | Chemical Engineering Thermodynamics II | |
| CHE 3203 | Fluid Flow Operations ¹ | |
| CHE 3213 | Heat Transfer Operations ¹ | |
| 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 | |
| Oral Communication Requirement | | |
| Fulfilled in CHE 3222, CHE 3232, CHE 4134 and CHE 4233 | | |
| Writing Requirement | | |
| GE 3513 | Technical Writing | 3 |
| Computer Literacy | | |
| Fulfilled in CHE 2213 and CHE 4134 | | |
| Choose one of the following sets of courses to complete the degree: | | 19 |
| Chemical Engineering Practice Concentration (CHEP) | | |
| EM 2413 | Engineering Mechanics I | |
| or ECE 3183 | Electrical Engineering Systems | |
| CHE 3331 | Professional Development Seminar | |
| CH 4413 | Thermodynamics and Kinetics | |
| Chemical Engineering Elective ² | | |
| Chemistry Elective ³ | | |
| Technical Electives ³ | | |
| (It is strongly recommended that CHE 4313 Transport Phenomena be used as a technical elective) | | |
| Chemical Engineering Research/Development Concentration (CERD) | | |
| 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 ³ | | |
| Biomolecular Engineering Concentration (BIOM) | | |
| BIO 1134 | Biology I | |
| BIO 1144 | Biology II | |
| BIO 3304 | General Microbiology | |
| BCH 4603 | General Biochemistry I | |

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|------------------------------|--|------------|
| 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 |
| or EN 1104 | Expanded English 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 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 |
| MA 3253 | Differential Equations I | 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 |
| PH 2213 | Physics I | 3 |

Geology & Geography Electives (Choose two - at least one must be a Geology Elective; a second can be Geography selected from the list below) 6

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|---------|--|---|
| GG 4063 | Earth and Atmospheric Energy Resources | |
| GG 4233 | Applied Geophysics | |
| GG 4304 | Principles of Sedimentary Deposits I | |
| GG 4413 | | |
| GG 4443 | Principles of Sedimentary Deposits II | |
| GG 4633 | Introduction to Geochemistry | |
| GR 4303 | Principles of GIS | 3 |
| GR 4313 | Advanced GIS | 3 |
| GR 4323 | Cartographic Sciences | 3 |

Major Core - Engineering Topics

| | | |
|----------|---------------------------------------|---|
| PTE 1101 | Introduction to Petroleum Engineering | 1 |
| CHE 2114 | Mass and Energy Balances | 4 |

| | | |
|---|--|------------|
| CHE 2213 | Chemical Engineering Analysis | 3 |
| CHE 3113 | Chemical Engineering Thermodynamics I | 3 |
| CHE 3203 | Fluid Flow Operations | 3 |
| CHE 3213 | Heat Transfer Operations | 3 |
| CHE 3413 | Engineering Materials | 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 4983 | Petroleum Engineering Capstone Design | 3 |
| PTE 4993 | Petroleum Economic Analysis | 3 |
| Writing Requirement | | |
| GE 3513 | Technical Writing | 3 |
| Oral Communication Requirement - Fulfilled in PTE 3902, PTE 3912, and PTE 4993 | | |
| Computer Literacy - Fulfilled in CHE 2213 and PTE 4993 | | |
| Technical Electives | | 6 |
| Total Hours | | 128 |

Petroleum Engineering Minor

The minor in Petroleum Engineering consists of 7 courses for a total of 21 credit hours. Engineering undergraduate students enrolled at Mississippi State University may be admitted into the minor program during any semester (fall, spring, or summer). All hours earned in the Petroleum Engineering minor program must be taken at MSU. A minimum GPA of 2.5 is required in all courses in the minor program. The Undergraduate Coordinator for the Swalm School of Chemical Engineering will oversee all admission decisions.

Required Courses

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|--|--|-----------|
| PTE 3903 | Petroleum Reservoir Fluid Properties | 3 |
| 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 4923 | Completion Design | 3 |
| Choose one of the following electives: | | 3 |
| PTE 4913 | Petroleum Reservoir Engineering 2 | |
| PTE 4953 | Formation Evaluation | |
| PTE 4963 | Oil Recovery Methods | |
| Total Hours | | 21 |