

# Chemical Engineering

## WHAT IS CHEMICAL ENGINEERING?

Chemical engineers work on the production or use of chemicals and biochemicals. They design equipment and processes for large-scale chemical manufacturing, plan and test methods of manufacturing products and treating byproducts, and supervise production. Chemical engineers also work in a variety of manufacturing industries other than chemical manufacturing, such as those producing energy, pharmaceuticals, electronics, food, and others. They also work in healthcare, biotechnology, and business services. Some may specialize in a particular chemical process, such as oxidation or polymerization. Others specialize in a particular field, such as materials science, or in the development of specific products. They must be aware of all aspects of chemicals manufacturing and how the manufacturing process affects the environment and the safety of workers and consumers.\*

### NEEDED SKILLS:

- Critical thinking & problem-solving
- Attention to detail
- Data analysis
- Communication and active listening skills
- Scientific method
- Organization of information
- Time management
- Teamwork\*\*

### JOB TITLES

- Chemical Engineer
- Process Engineer
- Product Engineer
- Refinery Process Engineer
- Operations Manager
- Research Scientist\*\*

### SALARIES

**\$94,360 \***

The nationwide average salary for employees with a bachelor's degree in Chemical Engineering

**\$73,547**

UM graduates average starting salaries  
*Courtesy of the Engineering Career Resource Center*

### INDUSTRIES AND OCCUPATIONS

- Scientific research and development
- Chemical manufacturing
- Synthetic materials manufacturing
- Petroleum & coal products manufacturing
- Pharmaceutical industry
- Biomedical industry
- Federal Government
- Food Industry
- Business management \*\*

### JOB OUTLOOK

Employment of chemical engineers is expected to grow 2% from 2014 to 2024, slower than the average for all occupations. Demand for chemical engineers' services depends largely on demand for the products of various manufacturing industries. Employment growth will only be sustained by the ability of these engineers to stay on the forefront of new, emerging technologies.\*

### MORE INFORMATION

- [www.myplan.com](http://www.myplan.com)
- [stats.bls.gov/ooh](http://stats.bls.gov/ooh)
- <http://www.aiche.org/> (American Institute of Chemical Engineers)
- <http://www.careercornerstone.org/chemeng/chemeng.htm>
- Engineering Career Resource Center, 230 Chrysler
- See Dr. Montgomery, ChE advisor. Sign up through Sign up through the link at: [www.engin.umich.edu/che/undergraduate](http://www.engin.umich.edu/che/undergraduate).

\*Information adapted from <http://www.bls.gov/ooh/>

\*\*Information from: [www.myplan.com](http://www.myplan.com)

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### WHICH ChE CLASSES SHOULD YOU START WITH?

If you place into Chem 210/211 (Organic Chemistry I) first semester of your freshman year, it is highly recommended that you take it, followed by Chem 215/216 (Organic Chemistry II) the following semester. You must have completed Math 116 by the time you start your sophomore year. You should then elect your first ChE class, ChE 230 in the fall semester of your sophomore year, as it is only offered in the fall, along with Math 215 and Physics 140/141 if you have not taken them yet. Note: The ChE department requires students to take either Econ 101 or Econ 102; this course will also count toward your Intellectual Breath requirement for engineering. Read more at: [www.engin.umich.edu/che](http://www.engin.umich.edu/che)

### COURSE DESCRIPTIONS

#### **CHEM 210/211 – 5 credits**

##### **Structure and Reactivity/Investigations in Chemistry**

This is Organic Chemistry I and lab. See Chemistry website for more detailed course description.

#### **CHEM 215/216 – 5 credits**

##### **Structure and Reactivity II/Synthesis and Characterization of Organic Compounds**

This is Organic Chemistry II and lab. See Chemistry website for more detailed course description.

#### **CHE 230 – 4 credits**

##### **Material and Energy Balances ONLY OFFERED FALL TERM**

*Prerequisites: Engr 100, Engr 101, Chem 130, and Math 116.*  
An introduction to material and energy balances in chemical engineering applications, including environmental and biological systems. Engineering problem solving, the equilibrium concept, first law of thermodynamics. Introduction to chemical engineering as a profession.

#### **CHE 330 – 4 credits**

##### **Chemical and Engineering Thermodynamics ONLY OFFERED WINTER TERM**

*Prerequisite: ChE 230.*

Development of fundamental thermodynamic property relations and complete energy and entropy balances. Analysis of heat pumps and engines, and use of combined energy-entropy balance in flow devices. Calculation and application of total and partial properties in physical and chemical equilibria. Prediction and correlation of physical/chemical properties of various states and aggregates. Elements of statistical thermodynamics.

#### **CHE 341 – 4 credits**

##### **Fluid Mechanics ONLY OFFERED WINTER TERM**

*Prerequisites: Physics 140, Math 215, and ChE 230.*

Fluid mechanics for chemical engineers. Mass, momentum, and energy balances on finite and differential systems. Laminar and turbulent flow in pipes, equipment, and porous media. Polymer processing and boundary layers. Potential, two-phase, and non-Newtonian flow.