College of Engineering

# Industrial and Manufacturing Systems

## Overview

Industrial engineers design and improve the way goods and services are produced and delivered. Using mathematics, science and engineering skills, they work to increase individual and system productivity, improve product quality and design safe workplaces.

Industrial engineers figure out how to do things better. They work to eliminate waste of time, money, materials and other resources. Most importantly, they are responsible for improving the overall effectiveness of an organization. The industrial and manufacturing systems engineering department at Kansas State University has been educating young engineers for more than half a century. While still stressing manufacturing process and systems, today we increasingly emphasize the application of industrial engineering to service industries.

## Professional options

### Careers

Industrial engineers are in high demand across the United States and throughout the world. The U.S. Bureau of Labor predicts industrial engineering jobs to grow at a rate of 14 percent in the coming decade. Most of our students have job offers before they graduate.

Industrial engineers are found in nearly all industries — particularly manufacturing, service, health care, government and financial organizations. Our graduates work as quality engineers, operations research analysts, operations management associates, process engineers and management consultants, among other positions.

The department has an active alumni base that is interested in the success of the department and its graduates. Many of our graduates have reached the top of their profession, becoming executive officers of top corporations, multi-star generals, members of the National Academy of Engineering and leaders of major universities. Our alumni are frequently on campus giving presentations, at career fairs and attending department and universitywide activities.

**Points of pride**

Kansas State University industrial and manufacturing systems' student chapter of the Institute of Industrial Engineers has been awarded the organization's 2012 Gold Award for the fifth consecutive year. The award recognizes the top student chapters in the nation

### Employers

A few of the companies that have recently recruited our graduates are Deloitte Consulting, Exxon Mobil, Lockheed Martin, Procter and Gamble, J.B. Hunt and Garmin. A sampling of what some of our recent graduates are doing includes:

- Working as a global network modeler for an international oil and gas company with responsibility for the supply chain model in Europe, Africa and the Middle East.
- Performing cost analyses for a large North American transportation logistics company.
- Manufacturing and engineering associate for one of the world's largest food manufacturers.
- Performing facilities planning and ergonomic studies for a major aircraft manufacturing company.

### Job Experience

Internships and co-ops are important ways students gain the experience they need to enter the workforce ready to contribute and succeed. In addition to valuable work skills, these opportunities help students determine their career path and may lead to full-time employment. On average, students complete two internships by the time they graduate.

## Academics

The industrial engineering curriculum is based on a strong background in mathematics and science. In our curriculum, the first two academic years are used to build the knowledge and experience necessary for our students to learn and apply fundamental engineering concepts and principles.

Courses within the major are a blend of engineering and business topics. Our courses are taught almost exclusively by faculty. The typical size for most department classes is fewer than 40 students.

We emphasize teamwork and group projects in our learning experience to help our students develop the skills necessary for success in today's work environment. Our Senior Design course gives students the opportunity to work on a real-world problem for an organization. In MSDA Manufacturing Systems Design and Analysis, students create and run their own business, from product design and production to marketing, sales and distribution.

Students may choose an area of specialization in engineering management, ergonomics, manufacturing engineering or operations research. Additionally, high-performing students can earn their bachelor's and master's degree concurrently. Graduates typically complete both degrees in about one calendar year beyond the time it would take to complete the bachelor's alone. To apply, students must have a cumulative GPA of at least 3.25 after having completed 80 credit hours toward the industrial engineering degree.

K-State offers a number of resources to assist students in their studies. In addition to these universitywide resources, the College of Engineering offers the Scholars Assisting Scholars program, a free tutoring service designed to support student success for incoming science and engineering majors. Industrial engineering students are each assigned a faculty advisor who is available to help them with course selection, enrollment and career planning.

## Activities

### Clubs

The department has active student chapters of the Institute of Industrial Engineers and Society of Manufacturing Engineers, which host a number of academic and social events for members. Activities include mentor day, workshops, regional and national conferences, open house displays, student/faculty picnics, and intramurals. K-State's chapter has received the Gold Award in the national chapter recognition completion for four consecutive years. Additionally, many students are involved in college and universitywide organizations such as Steel Ring, Engineering Ambassadors and the Student Governing Association.

### Study abroad

Each year students choose to study abroad. For many, this is one of the most rewarding experiences in their college career. Recently, students have traveled to the Czech Republic, Turkey and Australia. Similarly, many students participate in alternative spring break or winter/summer intersession faculty-led trips abroad.

# Financial assistance

Applications for admission are accepted up to 15 months before the first class day each semester. Apply for admission and fill out the Kansas State University scholarship application at k-state.edu/admit/apply.

The priority date for incoming freshmen to submit the K-State scholarship application is Nov. 1, or Feb. 1 for transfer students. Students should submit their Free Application for Federal Student Aid by March 1. For additional details, visit k-state.edu/sfa.

Future students are encouraged to visit the K-State campus and the department. Please let us know when you are planning to come, and we'll arrange for a faculty member to be available to answer your questions about the department, the classes you'd be taking and the profession. To set up an appointment, visit k-state.edu/admissions.

# Suggested course work

## Bachelor of Science in industrial engineering

127 hours. Accredited by the Engineering Accreditation Commission of ABET, abet.org.

### Freshman

| Hrs. | Fall semester | |
|---|---|---|
| 4 | MATH 220 | Analytic Geometry and Calculus I |
| 4 | CHM 210 | Chemistry I |
| 3 | ENGL 100 | Expository Writing[1] |
| 3 | IMSE 201 | Introduction to Industrial Engineering |
| 3 | Humanities or social science elective | |
| 0 | IMSE 015 | Engineering Assembly |
| 17 | | |

| Hrs. | Spring semester | |
|---|---|---|
| 2 | IMSE 250 | Introduction to Manufacturing Processes |
| 1 | IMSE 251 | Introduction to Manufacturing Processes Lab |
| 4 | MATH 221 | Analytic Geometry and Calculus II |
| 3 | ECON 120 | Principles of Microeconomics |
| 2 | ME 212 | Engineering Graphics |
| 3 | ACCTG 231 | Accounting for Business Operations |
| 2 | COMM 105 | Public Speaking 1A |
| 0 | IMSE 015 | Engineering Assembly |
| 17 | | |

### Sophomore

| Hrs. | Fall semester | |
|---|---|---|
| 4 | MATH 222 | Analytic Geometry and Calculus III |
| 3 | STAT 510 | Introduction to Probability and Statistics I |
| 5 | PHYS 213 | Engineering Physics I |
| 0 | IMSE 015 | Engineering Assembly |
| 3 | Humanities elective | |
| 15 | | |

| Hrs. | Spring semester | |
|---|---|---|
| 3 | MATH 551 | Applied Matrix Theory |
| 3 | STAT 511 | Introduction to Probability and Statistics II |
| 5 | PHYS 214 | Engineering Physics II |
| 2 | IMSE 530 | Engineering Economic Analysis |
| 1 | IMSE 532 | Industrial Project Evaluation |
| 0 | IMSE 015 | Engineering Assembly |
| 3 | Social science elective | |
| 17 | | |

### Junior

| Hrs. | Fall semester | |
|---|---|---|
| 3 | IMSE 560 | Operations Research I |
| 3 | IMSE 541 | Statistical Quality Control |
| 3 | MANGT 420 | Management Concepts |
| 0 | IMSE 015 | Engineering Assembly |
| 3 | Computer programming elective | |
| 3 | Engineering elective | |
| 15 | | |

| Hrs. | Spring semester | |
|---|---|---|
| 3 | IMSE 660 | Operations Research II |
| 3 | ENGL 415 | Written Communication for Engineers |
| 0 | IMSE 050 | Industrial Plant Studies |
| 0 | IMSE 015 | Engineering Assembly |
| 3 | IMSE elective | |
| 3 | Professional elective | |
| 3 | Engineering elective | |
| 15 | | |

### Senior

| Hrs. | Fall semester | |
|---|---|---|
| 3 | IMSE 623 | Industrial Ergonomics |
| 3 | IMSE 633 | Production Planning and Inventory Control |
| 3 | IMSE 643 | Industrial Simulation |
| 0 | IMSE 015 | Engineering Assembly |
| 3 | Professional elective | |
| 3 | Engineering elective | |
| 15 | | |

| Hrs. | Spring semester | |
|---|---|---|
| 4 | IMSE 580 | Manufacturing System Design and Analysis |
| 3 | IMSE 685 | Manufacturing Information Systems |
| 3 | IMSE 555 | Industrial Facility Layout and Design |
| 0 | IMSE 015 | Engineering Assembly |
| 3 | IMSE elective | |
| 3 | Professional elective | |
| 16 | | |

## Curriculum notes

**Computer programming elective:** The computer programming elective consists of three hours taken from CIS 200, CIS 209 or ME 400.

**Engineering electives**: The nine hours of basic engineering credit may not include more than six hours from a single department, and the nine hours must be selected from the following courses. Note, students planning to take the Fundamentals of Engineering exam would be advised to take their nine hours from classes with an *: BAE 345; CE 333, 530* and 533; (333 or 530 may be used, not both); CHE 350, 354*, 355*, 356*, 520 and 521; ECE 410, 511, 519*, and 571; ME 512*, 513, 571 and 573.

**Professional Electives**: The nine hours of professional electives are designed so that the student may specialize in an area of interest. Any of the following classes may count toward the professional elective requirement. Any IMSE class; any engineering, physics, chemistry, biochemistry, biology, geology, kinesiology above 300; any CIS class above 200; MATH 240 and any mathematics class above 500 except MATH 570 and 591; any statistics class above 500 except STAT 702, 703, 706 and 710; BIO 198, 201; CHEM 230; FINAN 450, 510, 520, 643; ACCTG 241, 331, 342, 433; ECON 510, 520, 530 540.

**Electives**: The electives must be selected from the industrial and manufacturing systems department. Each class must also be at least three credit hours.

**Substitutions**: IMSE 501 can substitute for MANGT 420; IMSE 591 and IMSE 592 can substitute for IMSE 580. Concurrent or prerequisite requirements for IMSE 591 are 24 credit hours of IMSE 500-level and above courses.

**K-State 8**: The courses required for a bachelor of science degree in industrial engineering satisfy five of the K-State 8 areas. The student must fulfill the aesthetic experience, global perspectives and historical perspectives tags. Most students will fill these tags with their humanities, social science or professional electives.

**Assembly requirement**: Each semester a student must enroll in IMSE 015 unless he or she is a concurrent B.S./M.S. student, in which case a student must enroll in either IMSE 015 or IMSE 892.

[1]Prerequisite for ENGL 415 is a B or better in ENGL 100. ENGL 200 must be taken if ENGL 100's grade was a C or lower.


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**K-State Engineering**

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