Sloan Career Cornerstone Center

Industrial Engineering Overview

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The Field

Industrial engineers determine the most effective ways to use the basic factors of production -- people, machines, materials, information, and energy -- to make a product or to provide a service. They are the bridge between management goals and operational performance. They are more concerned with increasing productivity through the management of people, methods of business organization, and technology than are engineers in other specialties, who generally work more with products or processes. Although most industrial engineers work in manufacturing industries, they may also work in consulting services, healthcare, and communications.

To solve organizational, production, and related problems most efficiently, industrial engineers carefully study the product and its requirements, use mathematical methods such as operations research to meet those requirements, and design manufacturing and information systems. They develop management control systems to aid in financial planning and cost analysis and design production planning and control systems to coordinate activities and ensure product quality. They also design or improve systems for the physical distribution of goods and services. Industrial engineers determine which plant location has the best combination of raw materials availability, transportation facilities, and costs. Industrial engineers use computers for simulations and to control various activities and devices, such as assembly lines and robots. They also develop wage and salary administration systems and job evaluation programs. Many industrial engineers move into management positions because the work is closely related.

The work of health and safety engineers is similar to that of industrial engineers in that it deals with the entire production process. Health and safety engineers promote worksite or product safety and health by applying knowledge of industrial processes, as well as mechanical, chemical, and psychological principles. They must be able to anticipate, recognize, and evaluate hazardous conditions as well as develop hazard control methods. They also must be familiar with the application of health and safety regulations.

Preparation

A bachelor's degree in engineering is required for almost all entry-level engineering jobs. College graduates with a degree in a physical science or mathematics occasionally may qualify for some engineering jobs, especially in specialties in high demand. Most engineering degrees are granted in electrical, electronics, mechanical, chemical, civil, or materials engineering. However, engineers trained in one branch may work in related branches. For example, many aerospace engineers have training in mechanical engineering. This flexibility allows employers to meet staffing needs in new technologies and specialties in which engineers may be in short supply. It also allows engineers to shift to fields with better employment prospects or to those that more closely match their interests. Most engineering programs involve a concentration of study in an engineering specialty, along with courses in both mathematics and science. Most programs include a design course, often accompanied by a computer or laboratory class. A degree in Industrial Engineering might include the following types of courses: operations research, production and inventory control, probability and statistics, and information systems. Industrial Engineering students would also study people systems, conduct cost analyses, evaluate facilities, and explore other elements of business.

Admission Requirements

Admissions requirements for undergraduate engineering schools include a solid background in mathematics (algebra, geometry, trigonometry, and calculus) and science (biology, chemistry, and physics), and courses in English, social studies, humanities, and computer and information technology. Bachelor's degree programs in engineering typically are designed to last 4 years, but many students find that it takes between 4 and 5 years to complete their studies. In a typical 4-year college curriculum, the first 2 years are spent studying mathematics, basic sciences, introductory engineering, humanities, and social sciences. In the last 2 years, most courses are in engineering, usually with a concentration in one branch. Some programs offer a general engineering curriculum; students then specialize in graduate school or on the job.

Co-ops

Internships and Coops provide students with a great opportunity to gain real-world experience while still in school. In addition to giving students direct experience in the field they are considering, interaction with others in the field can help provide perspective on career options.

Alternate Degree Paths

Some engineering schools and 2-year colleges have agreements whereby the 2-year college provides the initial engineering education, and the engineering school automatically admits students for their last 2 years. In addition, a few engineering schools have arrangements whereby a student spends 3 years in a liberal arts college studying pre-engineering subjects and 2 years in an engineering school studying core subjects, and then receives a bachelor's degree from each school. Some colleges and universities offer 5-year master's degree programs. Some 5-year or even 6-year cooperative plans combine classroom study and practical work, permitting students to gain experience and finance part of their education.

Graduate Training

Graduate training is essential for engineering faculty positions and many research and development programs, but is not required for the majority of entry-level engineering jobs. Many engineers obtain graduate degrees in engineering or business administration to learn new technology and broaden their education.

Accreditation

Those interested in a career in Industrial Engineering should consider reviewing engineering programs that are accredited by the Accreditation Board for Engineering and Technology, Inc. (ABET). ABET accreditation is based on an evaluation of an engineering program's student achievement, program improvement, faculty, curricular content, facilities, and institutional commitment. The following is a current list of universities offering accredited degree programs in Industrial Engineering.

- The University of Alabama in Huntsville
- The University of Alabama
- Arizona State University
- University of Arizona
- University of Arkansas
- Auburn University
- Bradley University
- California Polytechnic State University, San Luis Obispo
- California State Polytechnic University, Pomona
- California State University, East Bay
- California State University, Fresno
- University of California, Berkeley
- University of Central Florida
- University of Cincinnati
- Clemson University
- Cleveland State University
- Colorado State University-Pueblo
- Columbia University
- Florida A & M University/Florida State University (FAMU-FSU)
- Florida International University (University Park)
- University of Florida
- Georgia Institute of Technology
- University of Houston
- University of Illinois at Chicago
- University of Illinois at Urbana-Champaign
- Iowa State University
- University of Iowa
- Kansas State University
- Kettering University
- Lamar University
- Lehigh University
- Louisiana State University and A&M College
- Louisiana Tech University
- University of Louisville
- Marquette University
- University of Massachusetts Amherst
- University of Miami
- North Carolina Agricultural and Technical State University
- North Carolina State University at Raleigh
- North Dakota State University
- Northeastern University
- Northern Illinois University
- Northwestern University
- The Ohio State University
- Ohio University
- Oklahoma State University
- The University of Oklahoma
- Oregon State University
- Pennsylvania State University
- University of Pittsburgh
- Polytechnic University of Puerto Rico
- University of Puerto Rico, Mayaguez Campus
- Purdue University at West Lafayette
- Rensselaer Polytechnic Institute
- University of Rhode Island
- Rochester Institute of Technology
- Rutgers, The State University of New Jersey
- University of San Diego
- San Jose State University
- South Dakota School of Mines and Technology
- University of South Florida
- University of Southern California
- Southern Illinois University-Edwardsville
- St. Ambrose University
- St. Mary's University
- University of Tennessee at Knoxville
- Tennessee Technological University
- Texas A & M University
- Texas A & M University - Commerce
- University of Texas at Arlington
- University of Texas at El Paso
- Texas Tech University
- The University of Toledo

- University of Michigan
- University of Michigan-Dearborn
- Milwaukee School of Engineering
- University of Minnesota Duluth
- Mississippi State University
- University of Missouri-Columbia
- Montana State University - Bozeman
- Morgan State University
- University of Nebraska-Lincoln
- University of New Haven
- New Jersey Institute of Technology
- New Mexico State University
- State University of New York at Binghamton
- State University of New York at Buffalo
- Virginia Polytechnic Institute and State University
- University of Washington
- Wayne State University
- West Virginia University
- Western Michigan University
- Western New England College
- Wichita State University
- University of Wisconsin-Madison
- University of Wisconsin-Milwaukee
- University of Wisconsin-Platteville
- Worcester Polytechnic Institute
- Wright State University
- Youngstown State University

Day in the Life

Beginning engineering graduates usually work under the supervision of experienced engineers and, in large companies, also may receive formal classroom or seminar-type training. As new engineers gain knowledge and experience, they are assigned more difficult projects with greater independence to develop designs, solve problems, and make decisions. Engineers may advance to become technical specialists or to supervise a staff or team of engineers and technicians. Some may eventually become engineering managers or enter other managerial or sales jobs.

Teams and Coworkers

Almost all jobs in engineering require some sort of interaction with coworkers. Whether they are working in a team situation, or just asking for advice, most engineers have to have the ability to communicate and work with other people. Engineers should be creative, inquisitive, analytical, and detail-oriented. They should be able to work as part of a team and to communicate well, both orally and in writing. Communication abilities are important because engineers often interact with specialists in a wide range of fields outside engineering.

Tasks

Industrial engineers determine the most effective ways to use the basic factors of production -- people, machines, materials, information, and energy -- to make a product or to provide a service. They are the bridge between management goals and operational performance. They are more concerned with increasing productivity through the management of people, methods of business organization, and technology than are engineers in other specialties, who generally work more with products or processes. Although most industrial engineers work in manufacturing industries, they may also work in consulting services, healthcare, and communications.

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goods and services. Industrial engineers determine which plant location has the best combination of raw materials availability, transportation facilities, and costs. Industrial engineers use computers for simulations and to control various activities and devices, such as assembly lines and robots. They also develop wage and salary administration systems and job evaluation programs. Many industrial engineers move into management positions because the work is closely related.

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The Workplace

Industrial engineers, including health and safety, held about 194,000 jobs in 2002. Six in 10 of these jobs were in manufacturing industries, and an additional 1 in 10 worked in professional, scientific, and technical services firms, many of whom provide consulting services to manufacturing firms. Because their skills can be used in almost any type of organization, industrial engineers are more widely distributed among industries than are other engineers.

Earnings

Earnings for engineers vary significantly by specialty, industry, and education. Even so, as a group, engineers earn some of the highest average starting salaries among those holding bachelor's degrees.

▶ Salary Data

Entry-level salaries vary based on your areas of expertise, experience, education, supervisory responsibility, accountability for projects, and the geographic location, size, and industry of the employer. According the U.S. Department of Labor, Bureau of Labor Statistics, the median income for industrial engineers is $68,620.

In terms of starting salaries, the average starting salary for industrial engineers who have earned a Bachelor's degree is $55,067, while those with a Master's were offered $64,759. Ph.D. industrial engineers received average starting salaries of $77,364.

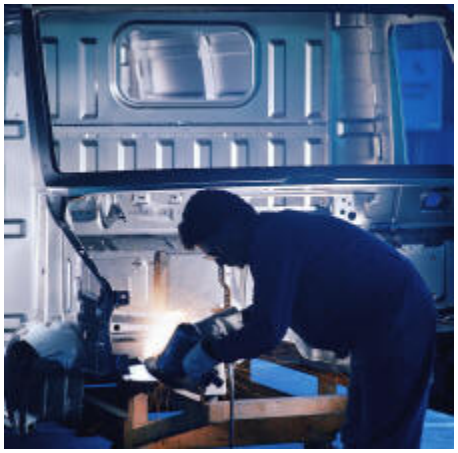
Employment

According to the U.S. Bureau of Labor Statistics, industrial engineers hold about 201,000 jobs. This represents 13.4% of the 1.5 million jobs held by engineers in the U.S. Six in 10 of these jobs were in manufacturing industries, and an additional 1 in 10 worked in professional, scientific, and technical services firms, many of whom provide consulting services to manufacturing firms. Because their skills can be used in almost any type of organization, industrial engineers are more widely distributed among industries than are other engineers.

The following is a short sample list of employers of organizations that require the skills of Industrial Engineers:

• American Express • Bausch & Lomb • Blue Cross Blue Shield • Boeing • Bosch • Eli Lilly • Federal Express • Fidelity Investments • Ford Motor Company	• Hershey's • General Dynamics • General Electric • General MotorsKodak • IBM Corporation • Intel • Lockheed Martin Corporation • Motorola • NASA	• PriceWaterhouseCoopers • Raytheon • Teradyne • UPS • W. L. Gore & Associates • Walt Disney Company • Xerox

Career Path Forecast



According to the U.S. Department of Labor, Bureau of Labor Statistics, industrial engineers are expected to have employment growth of 20 percent over the projections decade, faster than the average for all occupations. As firms look for new ways to reduce costs and raise productivity, they increasingly will turn to industrial engineers to develop more efficient processes and reduce costs, delays, and waste.

This should lead to job growth for these engineers, even in manufacturing industries with slowly growing or declining employment overall. Because their work is similar to that done in management occupations, many industrial engineers leave the occupation to become managers. Many openings will be created by the need to replace industrial engineers who transfer to other occupations or leave the labor force.

Professional Organizations

Professional organizations and associations provide a wide range of resources for planning and navigating a career in Nuclear Engineering. These groups can play a key role in your development and keep you abreast of what is happening in your industry. Associations promote the interests of their members and provide a network of contacts that can help you find jobs and move your career forward. They can offer a variety of services including job referral services, continuing education courses, insurance, travel benefits, periodicals, and meeting and conference opportunities. The following is a description of the Institute of Industrial Engineers. A broader list of professional associations is also available at www.careercornerstone.org.

Institute of Industrial Engineers (www.iienet.org)

IIE is the world's largest professional society dedicated solely to the support of the industrial engineering profession and individuals involved with improving quality and productivity. Founded in 1948, IIE is an international, non-profit association that provides leadership for the application, education, training, research, and development of industrial engineering. With more than 15,000 members and 280 chapters worldwide, IIE's primary mission is to meet the ever-changing needs of its membership, which includes undergraduate and graduate students, engineering practitioners and consultants in all industries, engineering managers, and engineers in education, research, and government.