Chemical Engineering Essay, Research Paper

Chemical Engineering

Scope

Chemical engineering is broader in scope than electrical, civil, or mechanical engineering, because it more or less consists of the equal use of the three main engineering cornerstones (mathematics, physics, and chemistry), while other professions are based on primarily the first two. The American Institute of Chemical Engineers (AIChE) describes chemical engineering as ?that branch of engineering concerned with the development and application of manufacturing processes in which chemical or certain physical changes of materials are involved? Chemistry, physics, and mathematics are the underlying sciences of chemical engineering, and economics its guide in practice .? The chemical engineer is considered an engineering generalist because of a unique ability (among engineers) to understand and exploit chemical change. Familiar with all forms of matter and energy and their manipulation, the chemical engineer leaves detailed specialization in one area of technology, such as construction, machine, design, or electronics to others.

History

Chemical engineering, which in most general terms is applied chemistry, existed even in early civilizations. Chemical engineering is the newest of the four big engineering professions, which are civil, mechanical, and electrical. Chemical engineering dates back to Ancient Greece where they distilled alcoholic beverages, as did the Chinese, who had learned to distill alcohol from rice by 800 BC. Aristotle, the Greek philosopher of the fourth century BC, wrote about the process of obtaining fresh water by evaporating water for m the sea.

Chemical engineering evolved form two main roots. The earlier was industrial chemistry, in which the work of the chemical engineer emerged from what was previously done by a team of chemists and a mechanical engineer. The other main root came around because of the great innovations from the US, which consisted of a connected approach to unit operations. These were physical separations such as distillations, absorption, and extraction in which the principles of mass transfer, fluid dynamics, and heat transfer were combined in equipment design. The foundations of the modern field of chemical engineering were laid out during the Renaissance, when experimentation and the questioning of accepted scientific theories became widespread. This period saw the development of many new chemical processes, such as those for sulfuric acid (for fertilizers and textile treatment) and alkali (for soap). The atomic theories of John Dalton and Amedeo Avogadro, developed in the early 1800?s, became and important theoretical underpinning for both chemistry and chemical engineering.

With the birth of large scale manufacturing in the mid-nineteenth century, modern chemical engineering began to take shape. Chemical manufacturers were soon required to seek out chemists who also had knowledge of manufacturing processes. These early chemical engineers were call chemical technicians or industrial chemists. The first course in chemical engineering was taught tin 1888 at the Massachusetts Institute of Technology, and by 1900 chemical engineer had become a widely used job title.

In the twentieth century chemical engineers were employed in increasing numbers to design new and more efficient ways to process chemicals and chemical products. In the US, chemical engineers were especially important in the development of petroleum-based fuels for the automotive industry. The achievements of chemical engineers–from large-scale production of plastics, antibodies (including penicillin), and synthetic rubbers to the development of high-octane gasoline?have gratefully affected our daily lives.

Nature of Work

Chemical engineers work in manufacturing, pharmaceuticals, healthcare, design and construction, pulp and paper, petrochemicals, food processing, specialty chemicals, polymers, biotechnology, and environmental health and safety industries, among others.

It is the smallest of the four major engineering disciplines (the others in order of size are electrical, mechanical, and civil). Because chemical engineers are rigorously trained in not only chemistry but also physics, mathematical and other physical and natural sciences, such as biology or geology, they are among the most versatile of all engineers, with many specialties and job roles and employed by many different industries. The largest share of chemical engineers, however, is involved in manufacturing industries, transforming raw materials into desired products.

Chemical engineers rely on their knowledge of mathematics and science?particularly chemistry? to overcome technical problems safely and economically. They use and apply their engineering knowledge to solve any technical challenges they may encounter. Their expertise is also applied in the areas of law, education, publishing, finance, and medicine, as well as in many other fields that require technical training.

Chemical engineers also construct the synthetic fibers that make our clothes more comfortable and water-resistant. They develop methods for mass-producing drugs, making them more affordable, and they create safer, more efficient methods of refining petroleum products, making energy and chemical sources more productive and cost effective. Chemical engineers also develop solutions to environmental problems, such as pollution control and remediation.

Chemical engineers face many of the same challenges that other professional?s face, and they meet these challenges by applying their technical knowledge, communication and teamwork and hard work. Chemical engineers are employed in many industries, representing a diverse range of products, employers, and services. Chemical engineers affect or control, at some stage, the materials of production of almost every article manufactured on an industrial scale.

Associations

Chemical Engineers are represented in the US by the AIChE, which has over 70,000 members, and was founded in 1908. The American Institute of Chemical Engineers (AIChE) is a nonprofit organization providing leadership to the chemical engineering profession. Representing 58,000 members in industry, academia, and government, AIChE provides forums to advance the theory and practice of the profession, upholds high professional standards and ethics, and supports excellence in education. Institute members range from undergraduate students, to entry-level engineers, to chief executive officers of major corporations.

In other countries, chemical engineers are represented by national organizations, such as the Canadian Society for Chemical Engineers, and the Institution of Chemical Engineers in Britain.

Requirements and Education

A bachelor?s degree in chemical engineering is generally considered the minimum educational requirement for entering the field. For some jobs a master?s or Ph.D. is necessary, especially for positions in research, teaching, and administration. The proportion of chemical engineers who have their master?s and doctorite degrees, has been much higher over the years than gor electrical, civil or mechanical engineers.

High school students interested in chemical engineering should take math and science courses offered by their schools. Computer science classes are also recommended. For college students, a chemical engineering program approved by the Accreditation Board for Engineering and Technology and the American Institute of Chemical Engineers is required. There are about 145 accredited undergraduate programs in chemical engineering in the US, offering bachelor?s degrees. Some engineering programs last five or six years, and often include work experience at nearby industries.

A typical engineering curriculum includes basic sciences (advanced mathematics, physics, chemistry, and some life sciences) and engineering sciences. Necessary communications courses include English, speech, technical writing, computer languages, and both manual and computer-generated graphics. Students can major in chemical engineering with a specialty in a specific area, such as biomedical engineering.

Chemical engineers must be licensed in order to work for the public sector. All fifty states, and Washington D.C. have specific licensing requirements, which include graduation from an accredited engineering program, passing a written exam, and having at least four years of engineering experience. About one-third of all chemical engineers are licensed. Those who are not are called registered engineers.

Important personal qualities for the chemical engineer are accuracy, objectivity, and perseverance. Chemical engineers should be inquisitive, open-minded, creative, and flexible, with problem-solving ability. To be competitive in the job market, a master of chemistry, a variety of science knowledge, and computer literacy, are essential. Practical experience gained through research projects, part-time, or co-op work, while not a requirement, are a big advantage in setting one away from the competition.