

Engineering Overview

The following information provides an overview of the Engineering Profession and brief descriptions of the Engineering Specializations corresponding to the Engineering programs that are currently being offered by The College of Engineering at The University of Texas at San Antonio.

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1. UTSA- College of Engineering

The College of Engineering at The University of Texas at San Antonio offers Bachelor of Science degrees in Biomedical, Civil, Computer, Electrical, and Mechanical Engineering.

Our Civil, Electrical and Mechanical Engineering programs at the UTSA College of Engineering are accredited by the Engineering Accreditation Commission of ABET, www.abet.org. Our Biomedical and Computer Engineering are newer programs and we are currently working toward accreditation.

Individuals enrolling in these degree programs are given an opportunity to develop a strong background in the engineering sciences and to learn the analysis, design and synthesis tools necessary to function well as active participants in many traditional, new and emerging areas of technology.

The College of Engineering has excellent laboratory facilities where students receive hands-on instruction by faculty. Computer-aided design (CAD) facilities, including state-of-the-art workstations, are routinely used in all programs. Some classes are taught by adjunct faculty from local industries, giving students the opportunity to interact with engineering professionals engaged in relevant engineering practice.

The engineering education incorporates demonstrable attributes of ABET-2000 criteria as core values. Graduates from the College of Engineering should have excellent opportunities for employment and pursuit of graduate degrees.

2. The Engineering Profession

Engineers apply the principles of science and mathematics to develop economical solutions to technical problems. Their work is the link between scientific discoveries and the commercial applications that meet societal and consumer needs.

Many engineers develop new products. During the process, they consider several factors. For example, in developing an industrial robot, engineers specify the functional requirements precisely; design and test the robot's components; integrate the components to produce the final design; and evaluate the design's overall effectiveness, cost, reliability, and safety. This process applies to the development of many different products, such as chemicals, computers, power-plants, helicopters, and toys.

In addition to their involvement in design and development, many engineers work in testing, production, or maintenance. These engineers supervise production in factories, determine the causes of a component's failure, and test manufactured products to maintain quality. They also estimate the time and cost required to complete projects. Supervisory engineers are responsible for major components or entire projects.

Engineers use computers extensively to produce and analyze designs; to simulate and test how a machine, structure, or system operates; to generate specifications for parts; to monitor the quality of products; and to control the efficiency of processes. Nanotechnology, which involves the creation of high-performance materials and components by integrating atoms and molecules, also is introducing entirely new principles to the design process.

Professional Preparation for Engineering

Engineers typically enter the occupation with a bachelor's degree in an engineering specialty, but some basic research positions may require a graduate degree. Engineers offering their services directly to the public must be licensed. Continuing education to keep current with rapidly changing technology is important for engineers.

A bachelor's degree in engineering is required for almost all entry-level engineering jobs. Most engineering degrees are granted in electrical, electronics, mechanical, or civil 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.

Engineers offering their services directly to the public must be licensed. In the United States, all 50 States and the District of Columbia require licensure for engineers who offer their services directly to the public. Engineers who are licensed are called Professional Engineers (PE). This licensure generally requires a degree from an ABET-accredited engineering program, 4 years of relevant work experience, and successful completion of a State examination.

Most engineers specialize. More than 25 major specialties are recognized by professional societies, and the major branches have numerous subdivisions.

3. Engineering Concentrations

a. Bioengineering

Bioengineering or Biomedical Engineering is a discipline that advances knowledge in engineering, biology, and medicine -- and improves human health through cross-disciplinary activities that integrate the engineering sciences with the biomedical sciences and clinical practice. Bioengineering/Biomedical Engineering combines engineering expertise with medical needs for the enhancement of health care. It is a branch of engineering in which knowledge and skills are developed and applied to define and solve problems in biology and medicine. Those working within the bioengineering field are of service to people, work with living systems, and apply advanced technology to the complex problems of medical care. Major advances in Bioengineering include the development of artificial joints, magnetic resonance imaging (MRI), the heart pacemaker, arthroscopy, angioplasty, bioengineered skin, kidney dialysis, and the heart-lung machine.

Biomedical engineers develop devices and procedures that solve medical and health-related problems by combining their knowledge of biology and medicine with engineering principles and practices. Many do research, along with medical scientists, to develop and evaluate systems and products such as artificial organs, prostheses (artificial devices that replace missing body parts), instrumentation, medical information systems, and health management and care delivery systems.

Biomedical engineers also may design devices used in various medical procedures, imaging systems such as magnetic resonance imaging (MRI), and devices for automating insulin injections or controlling body functions. Most engineers in this specialty need a sound background in another engineering specialty, such as mechanical or electronics engineering, in addition to specialized biomedical training.

Some specialties within biomedical engineering are biomaterials, biomechanics, medical imaging, rehabilitation engineering, and orthopedic engineering.

b. Electrical Engineering

Electrical and electronics engineers conduct research, and design, develop, test, and oversee the development of electronic systems and the manufacture of electrical and electronic equipment and devices. From the global positioning system that can continuously provide the location of a vehicle to giant electric power generators, electrical and electronics engineers are responsible for a wide range of technologies.

Electrical engineers design, develop, test, and supervise the manufacture of electrical equipment. Some of this equipment includes electric motors; machinery controls, lighting, and wiring in buildings; radar and navigation systems; communications systems; and power generation, control, and transmission devices used by electric utilities. Electrical engineers also design the electrical systems of automobiles and aircraft.

Although the terms electrical and electronics engineering often are used interchangeably in academia and industry, electrical engineers traditionally have focused on the generation and supply of power, whereas electronics engineers have worked on applications of electricity to control systems or signal processing. Electrical engineers specialize in areas such as power systems engineering or electrical equipment manufacturing.

Electronics engineers are responsible for a wide range of technologies, from portable music players to global positioning systems (GPS), which can continuously provide the location of, for example, a vehicle. Electronics engineers design, develop, test, and supervise the manufacture of electronic equipment such as broadcast and communications systems. Many electronics engineers also work in areas closely related to computers. However, engineers whose work is related exclusively to computer hardware are considered **Computer Hardware Engineers**. Electronics engineers specialize in areas such as communications, signal processing, and control systems or have a specialty within one of these areas—control systems or aviation electronics, for example.

c. Computer Engineering

Computer engineers (or computer hardware engineers) research, design, develop, test, and oversee the manufacture and installation of computer hardware, including computer chips, circuit boards, computer systems, and related equipment such as keyboards, routers, and printers. This field should not be confused with computer software engineers, who design and develop the software systems that control computers.

The work of computer hardware engineers is similar to that of electronics engineers in that they may design and test circuits and other electronic components; however, computer hardware engineers do that work only as it relates to computers and computer-related equipment.

The rapid advances in computer technology are largely a result of the research, development, and design efforts of these engineers.

They work on the design, planning, development, testing, and even the supervision of manufacturing of computer hardware -- including everything from chips to device controllers. They also focus on computer networks for the transmission of data and multimedia.

They work on the interface between different pieces of hardware and strive to provide new capabilities to existing and new systems or products. The work of a computer engineer is grounded in the hardware -- from circuits to architecture -- but also focuses on operating systems and software. Computer engineers must understand logic design, microprocessor system design, computer architecture, computer interfacing, and continually focus on system requirements and design.

It is primarily software engineers who focus on creating the software systems used by individuals and businesses, but computer engineers may also design and develop some software applications.

d. Mechanical Engineering

Mechanical engineering is one of the largest, broadest, and oldest engineering disciplines. Mechanical engineers use the principles of energy, materials, and mechanics to design and manufacture machines and devices of all types. They create the processes and systems that drive technology and industry.

The key characteristics of the profession are its breadth, flexibility, and individuality. The career paths of mechanical engineers are largely determined by individual choices, a decided advantage in a changing world.

Mechanics, energy and heat, mathematics, engineering sciences, design and manufacturing form the foundation of mechanical engineering. Mechanics includes fluids, ranging from still water to hypersonic gases flowing around a space vehicle; it involves the motion of anything from a particle to a machine or complex structure.

Mechanical engineers research, design, develop, manufacture, and test tools, engines, machines, and other mechanical devices. Mechanical engineering is one of the broadest engineering disciplines. Engineers in this discipline work on power-producing machines such as electric generators, internal combustion engines, and steam and gas turbines. They also work on power-using machines such as refrigeration and air-conditioning equipment, machine tools, material-handling systems, elevators and escalators, industrial production equipment, and robots used in manufacturing. Some mechanical engineers design tools that other engineers need for their work. In addition, mechanical engineers work in manufacturing or agriculture production, maintenance, or technical sales; many become administrators or managers.

e. Civil Engineering

Civil engineers design and supervise the construction of roads, buildings, airports, tunnels, dams, bridges, and water supply and sewage systems. They must consider many factors in the design process from the construction costs and expected lifetime of a project to government regulations and potential environmental hazards such as earthquakes and hurricanes.

Civil engineering, considered one of the oldest engineering disciplines, encompasses many specialties. The major ones are structural, water resources, construction, transportation, and geotechnical engineering. Many civil engineers hold supervisory or administrative positions, from supervisor of a construction site to city engineer. Others may work in design, construction, research, and teaching.

Civil engineering is grouped into seven specialty areas: structural, environmental, geotechnical, water resources, transportation, construction, and urban planning. In practice, these are not always hard and fixed categories, but they offer a helpful way to review a very diverse and dynamic field.

4. Additional Links:

The UTSA College of Engineering:

<http://engineering2.utsa.edu/undergraduate-studies/overview/>

Career Cornerstone:

<http://www.careercornerstone.org/engineering/engineering.htm>

The Occupational Outlook Handbook:

<http://www.bls.gov/ooh/architecture-and-engineering/home.htm>

ONET:

<http://www.onetonline.org/find/quick?s=Engineering>