

Engineering Disciplines

[This section has been duplicated in the Student Booklet]

Engineering - An Overview

Engineers are responsible for the design and delivery of solutions to meet the needs of modern society. They have contributed enormously to the development of the advanced society in which we live today. Engineering is described as the application of scientific and mathematical principals to problems in order to find a practical solution. It is concerned with creating and building 'things' – or 'systems' – that serve society. Engineering is about solving problems using a systematic approach and giving consideration to environmental, social and economic factors. Engineering deals with finding solutions that matter to ordinary people. From hip replacements to microwaves; from roads to natural gas; from chemicals to a cleaner environment; from the Internet to music videos, engineers are always involved. Engineering is the backbone of public utilities, transport systems, buildings, computers and the Internet, food production, diamond rings and sports cars.

The areas of work for engineers are diverse. Opportunities exist right across the spectrum from research and development to design, manufacturing, the service sectors and the business world. The technical areas of work include design, product management, software manufacture, production planning, material resource planning, logistics, manufacturing, quality control, assembly, commissioning, maintenance, health and safety, recycling and waste management, water resources, supply and sanitation, patents, standards and so on.

The area of technical work you might end up in depends on the type of engineering studied in college. However, there is always flexibility to move between the different types of engineering during your career. The main engineering disciplines are summarised below.

Main Types of Engineering

- Chemical and Process
- Civil
- Electrical
- Electronic
- Mechanical
- Aeronautical
- Biomedical
- Building Services
- Computer and Software
- Food and Agricultural
- Manufacturing and Industrial
- Materials
- Mechatronics/Electromechanical
- Structural

Engineering Disciplines (continued)

Aeronautical Engineering

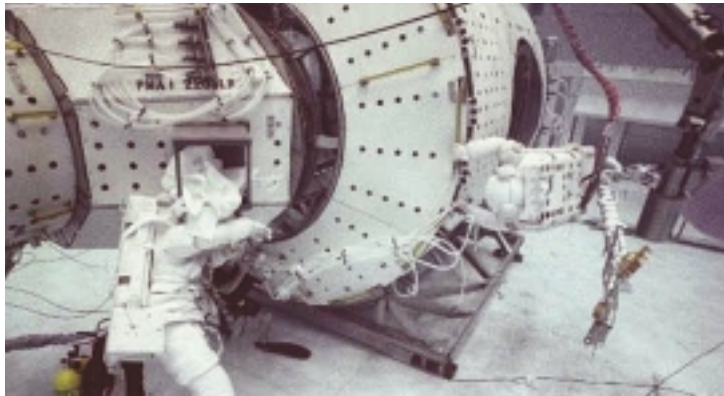
What is a Aeronautical Engineer?

Aeronautical engineers are responsible for developing extraordinary machines, from airplanes that weigh over a half a million pounds to spacecraft that travel over 17,000 miles an hour. They design, develop, and test aircraft, spacecraft, and missiles and supervise the manufacturing of these products.

Aeronautical engineers develop new technologies for use in aviation, defense systems, and space exploration, often specializing in areas such as structural design, guidance, navigation and control, instrumentation and communication, or production methods. They often use Computer-aided Design (CAD), robotics, and lasers and advanced electronic optics to assist them. They also may specialize in a particular type of aerospace product, such as commercial transports, military fighter jets, helicopters, spacecraft, or missiles and rockets.

Where Do They Work?

- Management in commercial aviation, defense and IT industry
- Flight crew in commercial and defense aviation
- Scientists at National Research establishments
- Research engineers in sport (Formula One)
- Aeronautical Engineers also work in mechanical engineers roles



Computer & Software Engineering

What is a Computer/Software Engineer?

Computer Engineers develop new applications for computers every day combining the two disciplines of electrical engineering and computer science. Computer & Software engineers develop both hardware and software. Projects can begin with the design of a single silicone chip and end with a large scale information system.

Engineering Disciplines (continued)

What Do They Do?

They design, write and test programmes and design networks, chips and processors. Computer engineers create new systems and devices which quickly become incorporated into our lives. The internet has revolutionised our use of the "personal computer", as has computer games. All branches of engineering now uses computers.

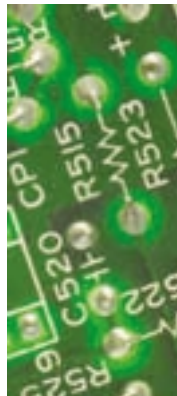
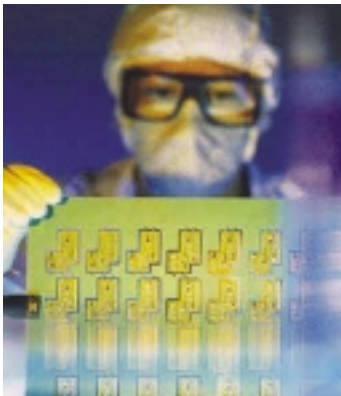
Three Main Areas:

- Hardware - designing networks linking computers together and designing new types of chips, processors and computers, eg. the iMac or PlayStation2
- Software - tells the computer what to do. It is the area involved in designing, writing, and testing programmes with an ultimate goal of producing flawless software, examples include Windows and games such as Tomb Raider.
- Information Systems - designing ways in which information is shared on computers.

Where Do They Work?

The world of IT is so fast moving, career opportunities in this area are extremely varied and include areas of:

- Research
- Consultancy & outsourcing
- Problem analysis
- Product design & development
- Industry solutions



Electrical/Electronic Engineering

What is an Electrical/Electronic Engineer?

Electrical and electronic engineers specialize in different areas such as power generation, transmission, and distribution; communications; and electrical equipment manufacturing, or a subdivision of these areas-industrial robot control systems or aviation electronics, for example. Electrical and electronics engineers design new products, write performance requirements, and develop maintenance schedules. They also test equipment, solve operating problems, and estimate the time and cost of engineering projects.

Engineering Disciplines (continued)

Where Do They Work?

Electrical and Electronic Engineers work in engineering and business consulting firms, government agencies, and manufacturers of electrical and electronic and computer and office equipment, industrial machinery, and professional and scientific instruments. Transportation, communications, and utilities firms as well as personnel supply services and computer and data processing services firms also employ electrical and electronic engineers.

Opportunities for electronics engineers in defense-related firms should improve as aircraft and weapons systems are upgraded with improved navigation, control, guidance, and targeting systems



Industrial Engineering

What is an Industrial Engineer?

Industrial Engineers are concerned with the effective and efficient operation of companies. This includes the planning and implementation of projects relating to facility layout, quality systems, manufacturing and logistical analysis, modelling systems and health & safety. These tasks ensure conditions are created in which industry and business can thrive.

Industrial Engineers focus on scientific approaches to solving management problems. Using such approaches problems can be modelled and risk analysis carried out before decisions are made. This multidisciplinary approach of Industrial Engineering results in many graduates ending up in management or project engineering positions within organisations. The insights into fields such as quality, health and safety, management science and systems engineering ensure a balanced view when solving problems. Industrial Engineers also benefit from this approach to problems solving and analysis skills having career opportunities across industry and service sectors.

Where Do They Work?

In the manufacturing industry where they maybe involved in analysing, designing and implementing programs to improve overall operational efficient in quality engineering positions where they can develop and implement programs in service and manufacturing industries in management science fields where models are developed to assist in analysing situations and risk analysis

Engineering Disciplines (continued)

Manufacturing & Industrial Engineering

What is Manufacturing Engineering?

Manufacturing Engineering is the type of engineering which organises ways of transforming materials and devices into products. Manufacturing engineers and technologists manage resources and use technology to produce quality goods and services for the benefit of society. Almost everything that affects our daily lives is manufactured - from machinery, food processing, pharmaceuticals, computers, electronics, toys, textiles, chemical products to health, medical, automotive and aircraft production.

Where Do They Work?

Most of today's manufacturing engineers and technicians work in high-tech, computerised environments filled with exciting and challenging opportunities. Graduates could be responsible for equipment design, factory layout, parts design, tool design, cost estimating, quality control and robotics.

Mechanical Engineering

What is a Mechanical Engineer?

Mechanical engineers research, develop, design, manufacture, and test tools, engines, machines, and other mechanical devices. They work on power-producing machines such as electric generators, internal combustion engines, and steam and gas turbines. They also develop 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. Mechanical engineers also design tools needed by other engineers for their work. The field of nanotechnology, which involves the creation of high-performance materials and components by integrating atoms and molecules, is introducing entirely new principles to the design process.

Where Do They Work?

Mechanical engineers work in many industries, and their work varies by industry and function. Some specialties include applied mechanics; computer-aided design and manufacturing; energy systems; pressure vessels and piping; and heating, refrigeration, and air-conditioning systems. Mechanical engineering is one of the broadest engineering disciplines. Mechanical engineers may work in production operations in manufacturing or agriculture, maintenance, or technical sales; many are administrators or managers.



Engineering Disciplines (continued)

Agriculture & Food Engineering

What is an Agricultural & Food Engineer?

An Agricultural & Food Engineer applies engineering technology to food production, food processing and bio-resources, turning raw material into everyday familiar foods such as pasta, pizza, yogurt and soft drinks. They also design food production and food processing systems and production machinery.

Such engineers look at each aspect of the food chain from food production to distribution. They develop and test new products and as nearly all foods will need some preservation, processing, packaging storage and distribution the field of Agricultural and Food engineering is an essential one. An expanding population, greater demand for food and choice, increased environment and resource requirement makes Agriculture & Food Engineering an extremely challenging career.

Where Do They Work?

- International food companies, private consulting organisations.
- Research for Industry and government.
- Work designing buildings (plant design), machinery manufacturers.
- Process design, Process control.



Biomedical Engineering

What is a Biomedical Engineer?

A Biomedical Engineer uses traditional engineering expertise to analyze and solve problems in biology and medicine, providing an overall enhancement of health care. Biomedical engineers may be called upon in a wide range of capacities: to design instruments, devices, and software, to bring together knowledge from many technical sources to develop new procedures, or to conduct research needed to solve clinical problems.

In this field there is continual change and creation of new areas due to rapid advancement in technology. Specialty areas within the field of biomedical engineering include: bioinstrumentation; biomaterials; biomechanics; cellular, tissue and genetic engineering; clinical engineering; medical imaging; orthopedic surgery; rehabilitation engineering; and systems physiology. These specialty areas frequently depend on each other. Often, the biomedical engineer who works in an applied field will use knowledge gathered by biomedical engineers working in other areas.

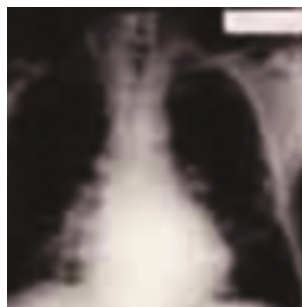
Engineering Disciplines (continued)

Where Do They Work?

Biomedical engineers are employed in industry, in universities, in hospitals, in research facilities of educational and medical institutions, in teaching, and in government regulatory agencies. They often serve a coordinating or interfacing function, using their background in both the engineering and medical fields.

Work done by biomedical engineers may include a wide range of activities such as:

Artificial organs (hearing aids, cardiac pacemakers, artificial kidneys and hearts, blood oxygenators, synthetic blood vessels, joints, arms, and legs). Advanced therapeutic and surgical devices (laser system for eye surgery, automated delivery of insulin, etc.). Computer modeling of physiologic systems (blood pressure control, renal function, visual and auditory nervous circuits, etc.).



Chemical & Process Engineering

What is a Chemical Engineer?

Almost everything you use in your daily life - plastics, metals, textiles, paper, food and beverages, toiletries, cosmetics and pharmaceuticals - has been made with the help of a chemical engineer. The process of converting raw (and sometimes recycled) materials into finished products is complex, involving research and development, design, construction, daily plant operation and management. And chemical engineers are there every step on the way.

Chemical Engineering is a basic discipline which serves industrial and other activities where processes occur in which materials undergo a change be it chemical or physical. The Chemical Engineer works on technical problems using their engineering knowledge to mass produce products that society demands and to do so under safe and environmentally friendly conditions at reasonable costs.

Chemical engineering usually involves preparing feed materials to an appropriate condition, enabling a reaction or reactions to occur, separating and purifying the products possibly by distillation or like process, controlling wastes and ultimately adding value to a raw material in the production of something useful to people. Chemical Engineers are also involved in the design construction and operation of large industrial plants to mass produce products.

Where Do They Work?

Chemical Engineering is a professional discipline and over many years it has become traditional for graduate chemical engineers to be employed in the chemical and petroleum industries. Today chemical engineers have broadened their horizons to encompass the metallurgical and mineral industries, manufacturing industries,

Engineering Disciplines (continued)

pharmaceutical and food industries, computer and electronic industries and for those not wishing to enter such industries the fields of finance, insurance, marketing and government departments and authorities offer many opportunities



Civil/Structural Engineering

What is a Civil/Structural Engineer?

Civil Engineering can be seen all around us and is probably one of the most familiar and certainly one of the oldest forms of engineering. Our daily lives are influenced by the Civil Engineer who ensures we have structures to live work and play in, fresh water in our taps, transport, power stations which create electricity and many more projects which we rely on each day.

Civil engineering is an exciting and challenging profession that is responsible for the creation of the basic needs and facilities (infrastructure) of modern society.

Where Do They Work?

- A Civil/Structural Engineer works with the design, construction and maintenance of major structures such as roads, railways, bridges, tunnels, airports, docks, canals and large structures of every kind from skyscrapers to offshore oil rigs.
- Local Authorities employ engineers to plan and oversee projects.
- Consultants designing, planning, overseeing specific projects.
- Contractors these civil engineers work organising those on site to get the job finished.
- Private clients Other options include Civil engineers working for manufacturers of construction materials and also on projects in developing countries.

