List of engineering branches

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Engineering is the discipline, art, and profession that applies scientific theory to design, develop, and analyze technological solutions. In the contemporary era, it is generally considered to consist of the major basic branches of chemical engineering, civil engineering, electrical engineering, mechanical engineering, and industrial engineering.[1] There are numerous other engineering subdisciplines and interdisciplinary subjects that are derived from concentrations, combinations, or extensions of the major engineering branches.

Contents

Chemical Engineering

Chemical engineering is the application of chemical, physical, and biological sciences to the process of converting raw materials or chemicals into more useful or valuable forms.

Subdiscipline	Scope	Major specialties
Biomolecular engineering	Focuses on the manufacturing of biomolecules.	▪ Genetic engineering (of whole genes and their chromosomes) ▪ Immunology and bio molecular/biochemical engineering ▪ Engineering of DNA and RNA (related to genetic engineering)
Materials engineering	Involves properties of matter (material) and its applications to engineering	▪ Metallurgical engineering, studies metals and their applications ▪ Ceramic engineering, the theory and processing of raw oxide material (e.g. alumina oxide), and advanced material that are polymorphic, polycrystalline, oxide, and non-oxide ceramics ▪ Polymer engineering, studies polymer materials and their applications ▪ Crystal engineering, the design and synthesis of molecular solid-state structures ▪ Biomaterials engineering, the study of matter relating to natural and living systems
Molecular engineering	Focuses on the manufacturing of molecules.	
Process engineering	Focuses on the design, operation, control, and optimization of chemical processes.	▪ Petroleum refinery engineering, the design of processes related to the manufacture of refined products ▪ Plastics engineering, the design of the production process of plastics products ▪ Paper engineering, the design of the production process of paper products ▪ Textile engineering, Textile engineering courses deal with the application of scientific and engineering principles to the design and control of all aspects of fiber, textile, and apparel processes, products, and machinery. These include natural and man-made materials, interaction of materials with machines, safety and health, energy conservation, and waste and pollution control. Additionally, students are given experience in plant design and layout, machine and wet process design and improvement, and designing and creating

Subdiscipline	Scope	Major specialties
		textile products. Throughout the textile engineering curriculum, students take classes from other engineering and disciplines including: mechanical, chemical, materials and industrial engineering.
Corrosion engineering	Is the specialist engineering discipline of applying scientific knowledge, natural laws and physical resources in order to design and implement materials, structures, devices, systems and procedures to manage the natural phenomenon known as corrosion. Generally related to Metallurgy, Corrosion Engineering also relates to non-metallics including ceramics. Corrosion Engineers often manage other not-strictly-corrosion processes including (but not restricted to) cracking, brittle fracture, crazing, fretting, erosion and more.	

Civil engineering

Civil engineering comprises the design, construction, and maintenance of the physical and natural built environments.

Subdiscipline	Scope	Major specialties
Environmental engineering	The application of engineering to the improvement and protection of the environment	▪ Ecological engineering, the design, monitoring and construction of ecosystems ▪ Fire protection engineering, the application of engineering to protect people and environments from fire and smoke ▪ Sanitary engineering, the application of engineering methods to improve sanitation of human communities ▪ Wastewater engineering Wastewater engineering is a type of engineering that comes from civil engineering and environmental engineering. A wastewater engineer determines the best way to transport or collect rainwater for human populations. Wastewater engineering also deals with the transportation and cleaning of blackwater, greywater, and irrigation water. Wastewater treatment and water reclamation are areas of concern in this field. Wastewater engineers map out topographical and geographical features of Earth to determine the best means of collection. They use sonar scanning in wells to determine volumes of water that can be used for human consumption. Using these types of data they are able to provide a means of collecting water. After collecting the water, it is their job to transport it to where it can be made available for use. ▪ Municipal or urban engineering, civil engineering applied to municipal issues such as water and waste management, transportation networks, subdivisions, communications, hydrology, hydraulics, etc.
Geotechnical engineering	Concerned with the behavior of earth materials at the site of a civil engineering project	▪ Mining engineering, the exploration, extraction and processing of raw materials from the Earth ▪ Foundation (engineering), the engineering of below ground foundations that support superstructures

Subdiscipline	Scope	Major specialties
Structural engineering	The engineering of structures that support or resist structural loads	▪ Earthquake engineering, the behavior of structures subject to seismic loading ▪ Wind engineering, the analysis of wind and its effects on the built environment ▪ Architectural engineering, application of engineering principles to building design and construction ▪ Ocean engineering, the design of offshore structures
Mining engineering	Is an engineering discipline that involves the practice, the theory, the science, the technology, and application of extracting and processing minerals from a naturally occurring environment. However, mining engineering is associated with many other sister departments like mineral processing and metallurgy, geotechnical engineering, and surveying. A mining engineer manages all phases of mining operations – from exploration and discovery of the mineral resource, through feasibility study, mine design, development of plans, production and operations to mine closure. With the process of Mineral extraction, some amount of waste and uneconomic material are generated which are the primary source of pollution in the vicinity of mines. Mining activities by their nature cause a disturbance of the natural environment in and around which the minerals are located. Mining engineers must therefore be concerned not only with the production and processing of mineral	

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	commodities, but also with the mitigation of damage to the environment both during and after mining as a result of the change in the mining area.	
Transport engineering	The use of engineering to ensure safe and efficient transportation of people and goods	▪ Traffic engineering, a branch of transportation engineering focusing on the infrastructure necessary for transportation ▪ Highway engineering a branch of engineering that deals with major roadways and transportation systems involving automobiles. Highway engineering usually involves the construction and design of highways ▪ Railway systems engineering
Water resources engineering	Prediction, planning, development and management of water resources	▪ Hydraulic engineering, concerned with the flow and conveyance of fluids, principally water; intimately related to the design of pipelines, water supply network, drainage facilities (including bridges, dams, levees, channels, culverts, storm sewers), and canals. ▪ River engineering is the process of planned human intervention in the course, characteristics, or flow of a river with the intention of producing some defined benefit—to manage the water resources, to protect against flooding, or to make passage along or across rivers easier. ▪ Coastal engineering, the study of the processes ongoing at the shoreline and construction within the coastal zone, often directed at combating erosion of coasts or providing navigational access. ▪ Groundwater engineering involves the analysis, monitoring and often modelling of groundwater source to better understand how much remains and if the water can be used for e.g. recharging reservoirs and irrigation.

Electrical engineering

Electrical engineering comprises the study and application of electricity, electronics, and electromagnetism.

Subdiscipline	Scope	Major specialties
Computer engineering	The design and control of computing devices with the application of electrical systems.	▪ Software engineering: the application of a systematic, disciplined, quantifiable approach to the development, operation, and maintenance of software, and the study of these approaches; that is, the application of engineering and computer science to software. ▪ Hardware engineering: designing, developing, and testing various computer equipment. Can range from circuit boards and microprocessors to routers. ▪ Network engineering: designing, deploying and maintaining computer networks, such as corporate networks or the Internet.
Electronic engineering	The design of circuits that use the electromagnetic properties of electrical components such as resistors, capacitors, inductors, diodes and transistors to achieve a particular functionality.	▪ Control engineering, focuses on the modeling of dynamic systems and the design of controllers using electrical circuits, digital signal processors and microcontrollers ▪ Telecommunications engineering
Optical engineering	The design of instruments and systems that utilize the properties of electromagnetic radiation.	
Power engineering	The generation, transmission and distribution of electricity, and the design of devices such as transformers, electric generators, electric motors, high-voltage engineering, and power electronics.	

Mechanical engineering

Mechanical engineering comprises the design, and analysis of heat and mechanical power for the operation of machines and mechanical systems.

Subdiscipline	Scope	Major specialties
Acoustical engineering	Concerns the manipulation and control of vibration, especially vibration isolation and the reduction of unwanted sounds	
Manufacturing engineering	Concerns dealing with different manufacturing practices and the research and development of systems, processes, machines, tools and equipment.	
Thermal engineering	Concerns heating or cooling of processes, equipment, or enclosed environments	▪ Air Conditioning ▪ Refrigeration ▪ Heating, Ventilating, Air-Conditioning and Refrigerating
Sports engineering	Is a field of engineering that involves the design, development and testing of sport equipment. The equipment used by athletes has always gone through technological design and development based on current knowledge and understanding.	
Vehicle engineering	The design, manufacture and operation of the systems and equipment that propel and control vehicles	▪ Automotive engineering, the design, manufacture and operation of motorcycles, automobiles, buses and trucks ▪ Naval architecture, the design, construction, operation and support of marine vehicles and structures ▪ Aerospace engineering, the application of engineering principles to aerospace systems such as aircraft and spacecraft ▪ Marine engineering often refers to the

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		engineering of boats, ships, oil rigs and any other marine vessel or structure, but also encompasses oceanographic engineering.
Power plant engineering	Field of engineering that designs, construct and maintains different types of power plants. Serves as the prime mover to produce electricity.	▪ Geothermal power plants ▪ Coal-fired power plants ▪ Hydroelectric power plants ▪ Diesel engine (ICE) power plants ▪ Tidal power plants ▪ Wind Turbine Power Plants ▪ Solar power plants
Energy Engineering	Is a broad field of engineering dealing with energy efficiency, energy services, facility management, plant engineering, environmental compliance and alternative energy technologies. Energy engineering is one of the more recent engineering disciplines to emerge. Energy engineering combines knowledge from the fields of physics, math, and chemistry with economic and environmental engineering practices. Energy engineers apply their skills to increase efficiency and further develop renewable sources of energy. The main job of energy engineers is to find the most efficient and sustainable ways to operate buildings and manufacturing processes. Energy engineers audit the use of energy in those processes and suggest ways to improve the systems. This means suggesting advanced lighting, better insulation, more efficient heating and cooling properties of buildings.[1] Although an energy engineer is concerned about obtaining and using energy in the most environmentally friendly ways, their field is not limited to strictly renewable energy like hydro, solar, biomass, or geothermal. Energy engineers are also employed by the fields of oil and natural gas extraction	

Software engineering

Software engineering is the study and an application of engineering to the design, development, implementation and maintenance of software in a systematic method.[2][3][4]

Subdiscipline	Scope	Major specialties
Computer-aided engineering	Computer-aided engineering (CAE) is the broad usage of computer software to aid in engineering analysis tasks. It includes Finite Element Analysis (FEA), Computational Fluid Dynamics (CFD), Multibody dynamics (MBD), and optimization.	▪ Software engineering: the application of a systematic, disciplined, quantifiable approach to the development, operation, and maintenance of software, and the study of these approaches; that is, the application of engineering and computer science to software. ▪ Hardware engineering: designing, developing, and testing various computer equipment. Can range from circuit boards and microprocessors to routers.
Cryptographic engineering	Cryptographic Engineering is the discipline of using cryptography to solve human problems. Cryptography is typically applied when trying to ensure data confidentiality, to authenticate people or devices, or to verify data integrity in risky environments.	▪ Information engineering, (IE) or information engineering methodology (IEM) is a software engineering approach to designing and developing information systems. It can also be considered as the generation, distribution, analysis and use of information in systems.
Teletraffic engineering	Telecommunications traffic engineering, teletraffic engineering, or traffic engineering is the application of traffic engineering theory to telecommunications. Teletraffic engineers use their knowledge of statistics including queuing theory, the nature of traffic, their practical models, their measurements and simulations to make predictions and to plan telecommunication networks such as a telephone network or the Internet. These tools and knowledge help provide reliable service at lower cost.	

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Web engineering	The World Wide Web has become a major delivery platform for a variety of complex and sophisticated enterprise applications in several domains. In addition to their inherent multifaceted functionality, these Web applications exhibit complex behavior and place some unique demands on their usability, performance, security and ability to grow and evolve. However, a vast majority of these applications continue to be developed in an ad-hoc way, contributing to problems of usability, maintainability, quality and reliability.[1][2] While Web development can benefit from established practices from other related disciplines, it has certain distinguishing characteristics that demand special considerations. In recent years, there have been developments towards addressing these considerations.	

Systems engineering

Systems engineering is an interdisciplinary field of engineering that focuses on how to design and manage complex engineering projects over their life cycles. Issues, such as reliability, logistics, and coordination of different teams (requirements management), evaluation measurements, and other disciplines become more difficult when dealing with large or complex projects. Systems engineering deals with work-processes, optimization methods, and risk management tools. It overlaps technical and human-centered disciplines such as control engineering, industrial engineering, organizational studies, and project management. Systems engineering ensures that all likely aspects of a project or system are considered, and integrated into a whole.

Interdisciplinary

Discipline	Scope	Major specialties
Aerospace engineering	The application of engineering principles to aerospace systems such as aircraft, spacecraft, and ground control systems. Formerly known as aeronautical engineering, concerns the design, construction, and science of both air and space vehicles, primarily on the systems level. Further concerned with the science of force and physics that are particular only to performance in Earth's atmosphere, and the expanse of space. Often placed within Vehicle engineering	▪ Aeronautics, the design and development of aircraft and air traffic control systems ▪ Astronautics, the design and development of spacecraft with an emphasis on spacecraft systems, the design of ground control systems for spacecraft, and the design of orbital mechanics for spacecraft missions
Agricultural engineering	The application of engineering principles to agricultural fields such as farm power and machinery, biological material process, bioenergy, farm structures, and agricultural natural resources.	▪ Aquaculture engineering, the study of cultured aquatic species and the production systems used in their culture. ▪ Biomechanical engineering ▪ Bioprocess engineering, the design and development of equipment and processes for the manufacturing of products from biological materials ▪ Biotechnical engineering ▪ Ecological engineering, the design, monitoring and construction of ecosystems ▪ Food engineering, concerns food processing, food machinery, packaging, ingredient manufacturing, instrumentation, and control. ▪ Forest engineering ▪ Health and Safety engineering ▪ Natural Resources engineering ▪ Machinery Systems engineering ▪ Information & Electrical Systems Engineering
Applied engineering	The field concerned with the application of management, design, and technical skills for the design and integration of systems, the execution of new product designs, the improvement of manufacturing	▪ Automation/control systems/mechatronics/robotics ▪ Computer-aided drawing and design (CADD) ▪ Construction ▪ Electronics

Discipline	Scope	Major specialties
	processes, and the management and direction of physical and/or technical functions of a firm or organization. Applied engineering degreed programs typically include instruction in basic engineering principles, project management, industrial processes, systems integration and control, quality control, and statistics.[5]	▪ General ▪ Graphics ▪ Nanotechnology
Biomedical engineering	is the application of engineering principles and design concepts to medicine and biology for healthcare purposes (e.g. diagnostic or therapeutic). This field seeks to close the gap between engineering and medicine. Much of the work in biomedical engineering consists of research and development, spanning a broad array of subfields (see below). Prominent biomedical engineering applications include the development of biocompatible prostheses, various diagnostic and therapeutic medical devices ranging from clinical equipment to micro-implants, common imaging equipment such as MRIs and EEGs, regenerative tissue growth, pharmaceutical drugs and therapeutic biologicals.	▪ Bioinstrumentation,is the application of electronics and measurement principles to develop devices and tools used in the diagnosis and treatment of disease. ▪ Bioinformatics,is one of the bio medical engineering which involves the development and usage of computer tools to collect and analyze data related to biology and medicine. The research work in bio informatics comprises the usage of sophisticated techniques to manage and generate data bases of gene sequences. ▪ Biomechanics,deals with the application of mechanics to medical field to solve biological and medical problems. It comprises the study of motion, material deformation, transport of chemical substances across biological membranes, and flow inside the body. Research in bio mechanics helped in the development of artificial heart valves, artificial kidney, artificial hip, etc. It also helps in the study of organs and the skeletal system. ▪ Biomaterial, deal with the materials and the living tissues that are implanted in the body. In the design of the implanted materials, understanding the properties of the living material is a vital aspect. ▪ Biomedical optics ▪ Biosignal processing,involves the processing of bio signals in order to extract the useful information for diagnostic and therapeutic purposes. It involves the study of cardiac signals to determine whether a patient can be susceptible to sudden cardiac

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		death, development of speech recognition systems which nullify the background noise, detection of brain signals that can be used to run a computer. ▪ Biotechnology, is a combination of various powerful tools that involve living organisms to make or modify products, develop micro organisms for specific purposes. ▪ Clinical engineering, is the application of technology for health care in hospitals. The clinical engineer forms a part of the health care team along with physicians, nurses and other hospital staff. Clinical engineers develop and maintain the computer data bases of medical instrumentation, equipment records and purchase as well as use the sophisticated medical instruments. They may also work on projects to adapt instrumentation to the specific needs of the physician and the hospital. This involves the interface of instruments with computers and customized software for data analysis and instrument control. In short, clinical engineers apply the latest technology to health care. ▪ Medical device / Medical equipment/ Health technology ▪ Medical imaging, is one of the unique techniques that involve the merging of physical phenomenon such as light, sound, magnetism, etc. with high speed electronic data processing, analysis and display to create an image. These images can completely be obtained using non-invasive techniques rather than using invasive techniques as they are less painful and can be repeated any number of times. ▪ Microtechnology and Nanotechnology, comprises the design and development of devices on the scale of a micrometer, and nano technology involves the development of devices on the scale of a nano meter. ▪ Neural engineering, is one of the emerging interdisciplinary fields in biomedical engineering. It involves the study of brain and nervous system; it also involves the replacement or restoration of lost sensory

Discipline	Scope	Major specialties
		and motor abilities, the development of neuro robots, the study of complexities of neural systems in nature and neuro electronics. ▪ Pharmaceutical engineering ▪ Rehabilitation engineering, is one of the new and upcoming fields in bio medical engineering. The main function of the rehabilitation engineers is to enhance the quality of life and capabilities of the individuals with physical and congenital impairments. They are concerned with developing assistive technology that improves the mobility, seating, communication of the patient. They also develop hardware and software computer adaptations to help the people with congenital impairments. ▪ Systems physiology, is the term used to describe that aspect of biomedical engineering in which engineering strategies, techniques and tools are used to gain a comprehensive and integrated understanding of the function of living organisms ranging from bacteria to humans.
Biological engineering	The application of engineering principles to the fields of biology and medicine.	▪ Bioacoustics ▪ Biochemical engineering, the design and construction of unit processes that involve biological organisms or molecules ▪ Biosystems engineering ▪ Biomedical engineering, the application of engineering principles and techniques to the medical and biological sciences ▪ Biotechnical engineering ▪ Biomolecular engineering ▪ Bioresource engineering ▪ Bioprocess engineering ▪ Cellular engineering ▪ Genetic engineering, the design and development of techniques to directly manipulate an organism's genes ▪ Food and Biological Process Engineering ▪ Health and Safety engineering ▪ Microbiological engineering

Discipline	Scope	Major specialties
		▪ Molecular engineering ▪ Protein engineering, the development of useful or valuable proteins ▪ Safety engineering ▪ Systems Biology ▪ Synthetic Biology ▪ Tissue engineering

Building services engineering	Building services engineering, technical building services, architectural engineering, or building engineering is the engineering of the internal environment and environmental impact of a building. It essentially brings buildings and structures to life.	▪ Architectural engineering
		▪ Mechanical engineering,
		  ▪ HVAC: heating, ventilation and air conditioning
		  ▪ Refrigeration
		  ▪ Plumbing or public health (MEP) engineering: Water services, drainage and plumbing
		▪ Electrical engineering,
		  ▪ Artificial lighting and emergency lighting,
		  ▪ ICT: Communication lines, telephones and IT networks
		  ▪ Low voltage (LV) systems, containment, distribution, distribution boards and switchgear
		  ▪ Lightning protection
		  ▪ Security, CCTV, and alarm systems
		▪ Vertical transportation: escalators and lifts
		▪ Fire engineering, including fire detection and fire protection
		▪ Natural lighting design
		▪ Building façades engineering
		▪ Energy supply – gas, electricity and renewable sources

Energy engineering	Energy engineering is a broad field of engineering dealing with energy efficiency, energy services, facility management, plant engineering, environmental compliance and alternative energy technologies. The domain of energy-engineering expertise combines selective subjects from the	▪ Solar engineering, solar energy engineering includes designing and building services based on solar energy, solar energy product development, solar PV systems, Solar Product Manufacturing and Solar Systems Integration. ▪ Wind engineering, Wind engineering analyzes effects of wind in the natural and the built environment and studies the

Discipline	Scope	Major specialties
	fields chemical, mechanical and electrical engineering. It is an interdisciplinary program which has relativity with electrical, mechanical and chemical engineering	possible damage, inconvenience or benefits which may result from wind. In the field of structural engineering it includes strong winds, which may cause discomfort, as well as extreme winds, such as in a tornado, hurricane or heavy storm, which may cause widespread destruction
Railway engineering	Railway engineering is a multi-faceted engineering discipline dealing with the design, construction and operation of all types of railway systems. It encompasses a wide range of engineering disciplines, including civil engineering, computer engineering, electrical engineering, mechanical engineering, industrial engineering and production engineering. A great many other engineering sub-disciplines are also called upon.	
Industrial engineering	The design and analysis of logistical and resource systems.	▪ Manufacturing engineering, the ability to plan the practices of manufacturing, to research and develop the tool, processes, machines and equipment, and to integrate the facilities and systems for producing quality products with optimal expenditure. ▪ Component engineering, the process of assuring the availability of suitable components required to manufacture a product. ▪ Systems engineering, focuses on issues such as logistics, the coordination of different teams, automatic control of machinery for complex engineering projects ▪ Construction engineering, the planning and management of construction projects ▪ Safety engineering, assuring that a life-critical system behaves as needed even when pieces fail ▪ Reliability engineering, optimising asset maintenance to minimise whole of life cost

Discipline	Scope	Major specialties
Mechatronics engineering	A hybrid of mechanical and electrical engineering, Commonly intended to examine the design of automation systems.	▪ Robotics ▪ Instrumentation engineering ▪ Optomechatronics engineering ▪ Biomechatronics engineering ▪ Avionics, the design of electronics and systems on board an aircraft or spacecraft
Management engineering	Management Engineering or Engineering Management is a specialized form of management that is concerned with the application of engineering principles to business practice. Engineering management is a career that brings together the technological problem-solving savvy of engineering and the organizational, administrative, and planning abilities of management in order to oversee complex enterprises from conception to completion.[1] A Master of Science in Engineering Management (MSEM, or MS in Engineering Management) is sometimes compared to a Master of Business Administration (MBA) for professionals seeking a graduate degree as a qualifying credential for a career in engineering management.[2]	
Military engineering	This is loosely defined as the art and practice of designing and building military weapons and vehicles, as well as maintaining lines of military transport and communications. This discipline of engineering is regarded as the oldest form of engineering and is also the precursor of the civil engineering discipline.	▪ Combat Engineering ▪ *Strategic support* ▪ *Ancillary support*
Nanoengineering	The practice of engineering on the nanoscopic scale	▪ Molecular engineering

Discipline	Scope	Major specialties
		▪ Materials science ▪ Instrumentation engineering ▪ Electronics
Nuclear engineering	The application of nuclear processes to engineering	▪ Medical Physics ▪ Nuclear fuel ▪ Radiation Protection
Petroleum engineering	The application of engineering principles to drilling for and producing crude oil and natural gas	▪ Reservoir engineering, the application of scientific principles to study the flow of fluids in underground reservoirs so as to obtain a high economic recovery. ▪ Drilling engineering, the design and application of equipment and techniques to drill wells. ▪ Production engineering, the design and application of equipment and techniques to bring well fluids to the surface and then separate out the various components.
Textile engineering	Textile engineering courses deal with the application of scientific and engineering principles to the design and control of all aspects of fiber, textile, and apparel processes, products, and machinery. These include natural and man-made materials, interaction of materials with machines, safety and health, energy conservation, and waste and pollution control. Additionally, students are given experience in plant design and layout, machine and wet process design and improvement, and designing and creating textile products. Throughout the textile engineering curriculum, students take classes from other engineering and disciplines including: mechanical, chemical, materials and industrial engineering.	▪ Apparel Engineering ▪ Fabric Engineering ▪ Industrial & Production Engineering ▪ Textile Engineering Management ▪ Textile Fashion & Design ▪ Textile Machinery Design & Maintenance ▪ Wet Process Engineering ▪ Yarn Engineering

See also

- Outline of engineering
- Railway systems engineering

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