

Chapter 1 : A Dictionary of Physics - Jonathan Law; Richard Rennie - Oxford University Press

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See Article History Engineering, the application of science to the optimum conversion of the resources of nature to the uses of humankind. The counterpart of the military engineer was the civil engineer, who applied essentially the same knowledge and skills to designing buildings, streets, water supplies, sewage systems, and other projects. Associated with engineering is a great body of special knowledge; preparation for professional practice involves extensive training in the application of that knowledge. Standards of engineering practice are maintained through the efforts of professional societies, usually organized on a national or regional basis, with each member acknowledging a responsibility to the public over and above responsibilities to his employer or to other members of his society. The function of the scientist is to know, while that of the engineer is to do. The scientist adds to the store of verified, systematized knowledge of the physical world; the engineer brings this knowledge to bear on practical problems. Engineering is based principally on physics, chemistry, and mathematics and their extensions into materials science, solid and fluid mechanics, thermodynamics, transfer and rate processes, and systems analysis. Unlike the scientist, the engineer is not free to select the problem that interests him; he must solve problems as they arise; his solution must satisfy conflicting requirements. Usually efficiency costs money; safety adds to complexity; improved performance increases weight. The engineering solution is the optimum solution, the end result that, taking many factors into account, is most desirable. It may be the most reliable within a given weight limit, the simplest that will satisfy certain safety requirements, or the most efficient for a given cost. In many engineering problems the social costs are significant. Engineers employ two types of natural resources—materials and energy. Materials are useful because of their properties: Important sources of energy include fossil fuels coal, petroleum, gas, wind, sunlight, falling water, and nuclear fission. Since most resources are limited, the engineer must concern himself with the continual development of new resources as well as the efficient utilization of existing ones. Of many treatises written by them, one in particular survives to provide a picture of engineering education and practice in classical times: In construction medieval European engineers carried technique, in the form of the Gothic arch and flying buttress, to a height unknown to the Romans. The sketchbook of the 13th-century French engineer Villard de Honnecourt reveals a wide knowledge of mathematics, geometry, natural and physical science, and draftsmanship. In Asia, engineering had a separate but very similar development, with more and more sophisticated techniques of construction, hydraulics, and metallurgy helping to create advanced civilizations such as the Mongol empire, whose large, beautiful cities impressed Marco Polo in the 13th century. Civil engineering emerged as a separate discipline in the 18th century, when the first professional societies and schools of engineering were founded. Civil engineers of the 19th century built structures of all kinds, designed water-supply and sanitation systems, laid out railroad and highway networks, and planned cities. England and Scotland were the birthplace of mechanical engineering, as a derivation of the inventions of the Scottish engineer James Watt and the textile machinists of the Industrial Revolution. The development of the British machine-tool industry gave tremendous impetus to the study of mechanical engineering both in Britain and abroad. Gramme led to the development of electrical and electronics engineering. The electronics aspect became prominent through the work of such scientists as James Clerk Maxwell of Britain and Heinrich Hertz of Germany in the late 19th century. Major advances came with the development of the vacuum tube by Lee De Forest of the United States in the early 20th century and the invention of the transistor in the mid-20th century. In the late 20th century electrical and electronics engineers outnumbered all others in the world. Chemical engineering grew out of the 19th-century proliferation of industrial processes involving chemical reactions in metallurgy, food, textiles, and many other areas. By the

use of chemicals in manufacturing had created an industry whose function was the mass production of chemicals. The design and operation of the plants of this industry became a function of the chemical engineer. Engineering functions Problem solving is common to all engineering work. The problem may involve quantitative or qualitative factors; it may be physical or economic; it may require abstract mathematics or common sense. Of great importance is the process of creative synthesis or design, putting ideas together to create a new and optimum solution. Although engineering problems vary in scope and complexity, the same general approach is applicable. First comes an analysis of the situation and a preliminary decision on a plan of attack. In line with this plan, the problem is reduced to a more categorical question that can be clearly stated. The stated question is then answered by deductive reasoning from known principles or by creative synthesis, as in a new design. The answer or design is always checked for accuracy and adequacy. Finally, the results for the simplified problem are interpreted in terms of the original problem and reported in an appropriate form. In order of decreasing emphasis on science, the major functions of all engineering branches are the following: Using mathematical and scientific concepts, experimental techniques, and inductive reasoning , the research engineer seeks new principles and processes. Development engineers apply the results of research to useful purposes. Creative application of new knowledge may result in a working model of a new electrical circuit, a chemical process, or an industrial machine. In designing a structure or a product, the engineer selects methods, specifies materials, and determines shapes to satisfy technical requirements and to meet performance specifications. The construction engineer is responsible for preparing the site, determining procedures that will economically and safely yield the desired quality, directing the placement of materials, and organizing the personnel and equipment. Plant layout and equipment selection are the responsibility of the production engineer, who chooses processes and tools, integrates the flow of materials and components, and provides for testing and inspection. The operating engineer controls machines, plants, and organizations providing power , transportation , and communication; determines procedures; and supervises personnel to obtain reliable and economic operation of complex equipment. Management and other functions.

Chapter 2 : Dictionary of Physics - Oxford Reference

A list of African Lexicons that may be found at an IU-Bloomington Library (Wells, ALF, and/or Lilly). The list comes from a project completed while.

Signal processing Signal processing deals with the analysis and manipulation of signals. For analog signals, signal processing may involve the amplification and filtering of audio signals for audio equipment or the modulation and demodulation of signals for telecommunications. For digital signals, signal processing may involve the compression, error detection and error correction of digitally sampled signals. Analog signal processing is still important in the design of many control systems. DSP processor ICs are found in many types of modern electronic devices, such as digital television sets, [57] radios, Hi-Fi audio equipment, mobile phones, multimedia players, camcorders and digital cameras, automobile control systems, noise cancelling headphones, digital spectrum analyzers, missile guidance systems, radar systems, and telematics systems. In such products, DSP may be responsible for noise reduction, speech recognition or synthesis, encoding or decoding digital media, wirelessly transmitting or receiving data, triangulating position using GPS, and other kinds of image processing, video processing, audio processing, and speech processing.

Telecommunications engineering Telecommunications engineering focuses on the transmission of information across a communication channel such as a coax cable, optical fiber or free space. Popular analog modulation techniques include amplitude modulation and frequency modulation. Once the transmission characteristics of a system are determined, telecommunication engineers design the transmitters and receivers needed for such systems. These two are sometimes combined to form a two-way communication device known as a transceiver. A key consideration in the design of transmitters is their power consumption as this is closely related to their signal strength. Satellite dishes are a crucial component in the analysis of satellite information.

Instrumentation engineering Instrumentation engineering deals with the design of devices to measure physical quantities such as pressure, flow, and temperature. For example, flight instruments measure variables such as wind speed and altitude to enable pilots the control of aircraft analytically. Similarly, thermocouples use the Peltier-Seebeck effect to measure the temperature difference between two points. Flight instruments provide pilots with the tools to control aircraft analytically.

Computer engineering Computer engineering deals with the design of computers and computer systems. This may involve the design of new hardware, the design of PDAs, tablets, and supercomputers, or the use of computers to control an industrial plant. However, the design of complex software systems is often the domain of software engineering, which is usually considered a separate discipline.

Related disciplines[edit] **The Bird VIP Infant ventilator** **Mechatronics** is an engineering discipline which deals with the convergence of electrical and mechanical systems. Such combined systems are known as electromechanical systems and have widespread adoption. Examples include automated manufacturing systems, [68] heating, ventilation and air-conditioning systems, [69] and various subsystems of aircraft and automobiles. They design, develop, test, and supervise the deployment of electrical systems and electronic devices. For example, they may work on the design of telecommunication systems, the operation of electric power stations, the lighting and wiring of buildings, the design of household appliances, or the electrical control of industrial machinery. Fundamental to the discipline are the sciences of physics and mathematics as these help to obtain both a qualitative and quantitative description of how such systems will work. Today most engineering work involves the use of computers and it is commonplace to use computer-aided design programs when designing electrical systems. Nevertheless, the ability to sketch ideas is still invaluable for quickly communicating with others.

The Shadow robot hand system Although most electrical engineers will understand basic circuit theory that is the interactions of elements such as resistors, capacitors, diodes, transistors, and inductors in a circuit, the theories employed by engineers generally depend upon the work they do. For example, quantum mechanics and solid state physics might be relevant to an engineer working on VLSI the design of integrated circuits, but are largely irrelevant to engineers working

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PHYSICS =**

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