

The discovery of electronics



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Hendrick Antoon Lorentz of The Netherlands predicted the electron theory of electrical charge in 1895, and in 1897 J. J. Thomson of England showed that the Edison effect current was indeed caused by negatively charged particles (electrons). This led to the work of Guglielmo Marconi of Italy, Lee De Forest of the United States, and many others, which laid the foundations of radio engineering. In 1930 the term electronics was introduced to embrace radio and the industrial applications of electron tubes.

Since 1947, when the transistor was invented by John Bardeen, William H. Brattain, and William B. Shockley, electronics engineering has been dominated by the applications of such solid-state electronic devices as the transistor, the semiconductor diode, and the integrated circuit. The branch of engineering concerned with the practical applications of electricity in all its forms, including those of the field of electronics. Electronics engineering is that branch of electrical engineering concerned with the uses of the electromagnetic spectrum and with the application of such electronic devices as integrated circuits, transistors, and vacuum tubes.

In engineering practice, the distinction between electrical engineering and electronics is based on the comparative strength of the electric currents used. In this sense, electrical engineering is the branch dealing with "heavy current"-that is, electric light and power systems and apparatuses-whereas electronics engineering deals with such "light current" applications as wire and radiocommunication, the stored-program electronic computer, radar, and automatic control systems. The distinction between the fields has become less sharp with technical progress.

For example, in the high-voltage transmission of electric power, large arrays of electronic devices are used to convert transmission-line current at power levels in the tens of megawatts. Moreover, in the regulation and control of interconnected power systems, electronic computers are used to compute requirements much more rapidly and accurately than is possible by manual methods. Electrical phenomena attracted the attention of European thinkers as early as the 17th century. Beginning as a mathematically oriented science, the field has remained primarily in that form; mathematical predication often precedes laboratory demonstration.

The most noteworthy pioneers include Ludwig Wilhelm Gilbert and Georg Simon Ohm of Germany, Hans Christian Orsted of Denmark, Andre-Marie Ampere of France, Alessandro Volta of Italy, Joseph Henry of the United States, and Michael Faraday of England. Electrical engineering may be said to have emerged as a discipline in 1864 when the Scottish physicist James Clerk Maxwell summarized the basic laws of electricity in mathematical form and predicted that radiation of electromagnetic energy would occur in a form that later became known as radio waves.

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The functions performed by electrical and electronics engineers include (1) basic research in physics, other sciences, and applied mathematics in order to extend knowledge applicable to the field of electronics, (2) applied research

based on the findings of basic research and directed at discovering new applications and principles of operation, (3) development of new materials, devices, assemblies, and systems suitable for existing or proposed product lines, (4) design of devices, equipment, and systems for manufacture, (5) field-testing of equipment and systems, (6) establishment of quality control standards to be observed in manufacture, (7) supervision of manufacture and production testing, (8) postproduction assessment of performance, maintenance, and repair, and (9) engineering management, or the direction of research, development, engineering, manufacture, and marketing and sales.