



# Electric Circuits Fundamentals (8th Edition)

*By Thomas L. Floyd*

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**Electric Circuits Fundamentals (8th Edition)** By Thomas L. Floyd

The 8th edition of this acclaimed book provides practical coverage of electric circuits. Well-illustrated and clearly written, the book contains a design and page layout that enhances visual interest and ease of use. The organization provides a logical flow of subject matter and the pedagogical features assure maximum comprehension. Some key features include:

Numerous examples in each chapter—Illustrate major concepts, theorems, and methods. This is a perfect reference for professionals with a career in electronics, engineering, technical sales, field service, industrial manufacturing, service shop repair, and/or technical writing.

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SUGGESTIONS FOR USING THIS TEXTBOOKAs mentioned before, this book is divided into two parts: DC Circuits and AC Circuits. The text can be used to accommodate a variety of scheduling and program requirements. Some suggestions follow: **Option 1:** A two-term dc/ac sequence should allow sufficient time to cover all or most of the topics in the book. Chapters 1 through 7 can be covered in the first term and Chapters 8 through 15 in the second term. **Option 2:** A modification of Option 1 is to add the coverage of capacitors through Section 9-5 and inductors through Section 11-5 to the first term do course. **Option 3:** Yet another modification to Option 1 for those who prefer to cover reactive components before covering reactive circuits is to cover Chapter 11 on inductors immediately after Chapter 9 on capacitors. Then follow with Chapter 10, Chapter 12, and so on. **Option 4:** A one-term do/ac sequence. Obviously, this approach will require selective and faster-paced coverage of much of the material. Since program requirements vary greatly, it is difficult to make specific suggestions for selective coverage. TO THE STUDENTAny career training requires hard work, and electronics is no exception. The best way to learn new material is by reading, thinking, and doing. This text is designed to help you along the way by providing an overview and objectives for each section, numerous worked-out examples, practice exercises, and review questions with answers. Don't expect every concept to be crystal clear after a single reading. Read each section of the text carefully and think about what you have read. Work through the example problems step-by-step before trying the related problem that goes with the example. Sometimes more than one reading of a section will be necessary. After each section, check your understanding by answering the section review questions. Review the chapter summary and equation list. Take the multiple-choice selftest. Finally, work the problems at the end of the chapter. Check your answers to the self-test at the end of the chapter and the odd-numbered problems against those provided at the end of the book. Working problems is the most important way to check your comprehension and solidify concepts. CAREERS IN ELECTRONICSThe field of electronics is very diverse, and career opportunities are available in many areas. Because electronics is currently found in so many different applications and new technology is being developed at a fast rate, its future appears limitless. There is hardly an area of our lives that is not enhanced to some degree by electronics technology. Those who acquire a sound, basic knowledge of electrical and electronic principles and are willing to continue learning will always be in demand. The importance of obtaining a thorough understanding of the basic principles contained in this text cannot be overemphasized. Most employers prefer to hire people who have both a thorough grounding in the basics and the ability and eagerness to grasp new concepts and techniques. If you have a good training in the basics, an employer will train you in the specifics of the job to which you are assigned. There are many types of job classifications for which a person with training in electronics technology may qualify. A few of the most common job functions are discussed briefly in the following paragraphs. **Service Shop Technician:** Technical personnel in this category are involved in the repair or adjustment of both commercial and consumer electronic equipment that is returned to the dealer or manufacturer for service. Specific areas include TVs, VCRs, CD players, stereo equipment, CB radios, and computer hardware. This area also offers opportunities for self-employment. **Industrial Manufacturing Technician:** Manufacturing personnel are involved in the testing of electronic products at the assembly-line level or in the maintenance and troubleshooting of electronic and electromechanical systems used in the testing and manufacturing of products. Virtually every type of manufacturing plant, regardless of its product, uses automated equipment that is electronically controlled. **Laboratory Technician:** These technicians are involved in breadboarding, prototyping, and testing new or modified electronic systems in research and development laboratories. They generally work closely with engineers during the development phase of a product. **Field Service Technician:** Field service personnel service and repair electronic equipment—for example, computer systems, radar installations, automatic banking equipment, and security systems—at the user's location. **Engineering Assistant/Associate Engineer:** Personnel in this category work closely with engineers in the implementation of a concept and in the basic design and development of electronic systems. Engineering assistants are frequently involved in a project from its initial design through the early manufacturing stages. **Technical Writer:** Technical writers compile technical information and then use the information to write and produce manuals and audiovisual materials. A broad knowledge of a particular

system and the ability to clearly explain its principles and operation are essential. **Technical Sales:**

Technically trained people are in demand as sales representatives for high-technology products. The ability both to understand technical concepts and to communicate the technical aspects of a product to a potential customer is very valuable. In this area, as in technical writing, competency in expressing yourself orally and in writing is essential. Actually, being able to communicate well is very important in any technical job category because you must be able to record data clearly and explain procedures, conclusions, and actions taken so that others can readily understand what you are doing.

**MILESTONES IN ELECTRONICS** Before you begin your study of electronics fundamentals, let's briefly look at some of the important developments that led to the electronics technology we have today. The names of many of the early pioneers in electricity and electromagnetics still live on in terms of familiar units and quantities. Names such as Ohm, Ampere, Volta, Farad, Henry, Coulomb, Oersted, and Hertz are some of the better known examples. More widely known names such as Franklin and Edison are also significant in the history of electricity and electronics because of their tremendous contributions. Short biographies of some of these pioneers, like shown here, are located throughout the text.

**The Beginning of Electronics:** Early experiments with electronics involved electric currents in vacuum tubes. Heinrich Geissler (1814-1879) removed most of the air from a glass tube and found that the tube glowed when there was current through it. Later, Sir William Crookes (1832-1919) found the current in vacuum tubes seemed to consist of particles. Thomas Edison (1847-1931) experimented with carbon filament bulbs with plates and discovered that there was a current from the hot filament to a positively charged plate. He patented the idea but never used it. Other early experimenters measured the properties of the particles that flowed in vacuum tubes. Sir Joseph Thompson (1856-1940) measured properties of these particles, later called *electrons*. Although wireless telegraphic communication dates back to 1844, electronics is basically a 20th century concept that began with the invention of the vacuum tube amplifier. An early vacuum tube that allowed current in only one direction was constructed by John A. Fleming in 1904. Called the Fleming valve, it was the forerunner of vacuum tube diodes. In 1907, Lee deForest added a grid to the vacuum tube. The new device, called the audiotron, could amplify a weak signal. By adding the control element, deForest ushered in the electronics revolution. It was with an improved version of his device that made transcontinental telephone service and radios possible. In 1912, a radio amateur in San Jose, California, was regularly broadcasting music! In 1921, the secretary of commerce, Herbert Hoover, issued the first license to a broadcast radio station; within two years over 600 licenses were issued. By the end of the 1920s radios were in many homes. A new type of radio, the superheterodyne radio, invented by Edwin Armstrong, solved problems with highfrequency communication. In 1923, Vladimir Zworykin, an American researcher, invented the first television picture tube, and in 1927 Philo T. Farnsworth applied for a patent for a complete television system. The 1930s saw many developments in radio, including metal tubes, automatic gain control, directional antennas, and more. Also started in this decade was the development of the first electronic computers. Modern computers trace their origins to the work of John Atanasoff at Iowa State University. Beginning in 1937, he envisioned a binary machine that could do complex mathematical work. By 1939, he and graduate student Clifford Berry had constructed a binary machine called ABC, (for Atanasoff-Berry Computer) that used vacuum tubes for logic and condensers (capacitors) for memory. In 1939, the magnetron, a microwave oscillator, was invented in Britain by Henry Boot and John Randall. In the same year, the klystron microwave tube was invented in America by Russell and Sigurd Varian. During World War II, electronics developed rapidly. Radar and very highfrequency communication were made possible by the magnetron and klystron. Cathode ray tubes were improved for use in radar. Computer work continued during the war. By 1946, John von Neumann had developed the first stored program computer, the Eniac, at the University of Pennsylvania. The decade ended with one of the most important inventions ever, the transistor. **Solid-State Electronics:** The crystal detectors used in early radios were the forerunners of modern solid-state devices. However, the era of solid-state electronics began with the invention of the transistor in 1947 at Bell Labs. The inventors were Walter Brattain, John Bardeen, and William Shockley. PC (printed circuit) boards were introduced in 1947, the year the transistor was invented. Commercial manufacturing of transistors began in Allentown, Pennsylvania, in

1951. The most important invention of the 1950s was the integrated circuit. On September 12, 1958, Jack Kilby, at Texas Instruments, made the first integrated circuit. This invention literally created the modern computer age and brought about sweeping changes in medicine, communication, manufacturing, and the entertainment industry. Many billions of "chips"—as integrated circuits came to be called—have since been manufactured. The 1960s saw the space race begin and spurred work on miniaturization and computers. The space race was the driving force behind the rapid changes in electronics that followed. The first successful "op-amp" was designed by Bob Widlar at Fairchild Semiconductor in 1965. Called the *uA709*, it was very successful but suffered from "latch-up" and other problems. Later, the most popular op-amp ever, the 741, was taking shape at Fairchild. This op-amp became the industry standard and influenced design of op-amps for years to come. By 1971, a new company that had been formed by a group from Fairchild introduced the first microprocessor. The company was Intel and the product was the 4004 chip, which had the same processing power as the Eniac computer. Later in the same year, Intel announced the first 8-bit processor, the 8008. In 1975, the first personal computer was introduced by Altair, and *Popular Science* magazine featured it on the cover of the January, 1975, issue. The 1970s also saw the introduction of the pocket calculator and new developments in optical integrated circuits. By the 1980s, half of all U.S. homes were using cable hookups instead of television antennas. The reliability, speed, and miniaturization of electronics continued throughout the 1980s, including "automated testing and calibrating of PC boards. The computer became a part of instrumentation and the virtual instrument was created. Computers became a standard tool on the workbench. The 1990s saw a widespread application of the Internet. In 1993, there were 130 websites, and now there are millions. Companies scrambled to establish a home page and many of the early developments of radio broadcasting had parallels with the Internet. In 1995, the FCC allocated spectrum space for a new service called Digital Audio Radio Service. Digital television standards were adopted in 1996 by the FCC for the nation's next generation of broadcast television.

**ACKNOWLEDGMENTS** Many capable people have been part of this revision for the fifth edition of *Electric Circuits Fundamentals*. It has been thoroughly reviewed and checked for both content and accuracy. Those at Prentice Hall who have contributed greatly to this project throughout the many phases of development and production include Rex Davidson, Katie Bradford, and Scott Sambucci. Lois Porter, whose attention to details is unbelievable, has once again done an outstanding job editing the manuscript. Jane Lopez has again provided the excellent illustrations and beautiful graphics work used in the text. As with the previous edition, Gary Snyder has checked the manuscript for accuracy. Also, Gary created the circuit files for the Electronics Workbench features in this edition and Karen Dickson at Frotel Technology created the CircuitMaker files. A thorough line-by-line review was done by my colleague Dave Buchla and many of the improvements and changes found in this edition were a result of his recommendations. I wish to express my appreciation to those already mentioned as well as the reviewers who provided many valuable suggestions and constructive criticism that greatly influenced this edition. These reviewers are Jerry L. Wilson, Lamar Institute of Technology; James K. Gee, ITT Technical Institute; William R. Kist, New England Institute of Technology; Peter Westray, Los Angeles Valley College; and Carl Jensen, DeVry Institute of Technology. Tom Floyd Users Review

**From reader reviews:**

April Young: Have you spare time for a day? What do you do when you have more or little spare time? Yeah, you can choose the suitable activity regarding spend your time. Any person spent all their spare time to take a walk, shopping, or went to typically the Mall. How about open or even read a book allowed *Electric Circuits Fundamentals* (8th Edition)? Maybe it is to be best activity for you. You realize beside you can spend your time together with your favorite's book, you can smarter than before. Do you agree with it is opinion or you have different opinion?

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