

# Preface

The eighth edition of *Electricity: Principles and Applications* utilizes the same philosophy of learning and teaching as was used in the previous editions. It assumes that the student has very limited or no knowledge of electrical theory and principles. Mastery of the material in this text will aid the student desiring an entry-level job in an occupation requiring an understanding of electricity. Mastering this material will also provide the student with the knowledge and skills needed to pursue further education in electricity and electronics.

This text has been written so that students with limited math and reading skills can gain a clear understanding of electricity and electric devices. Concepts are explained and developed by using a number of short, simple sentences rather than one long, complicated, convoluted sentence. It is never assumed that something is intuitively obvious.

Any mathematics beyond simple arithmetic is carefully explained and illustrated with examples before it is used to solve electric circuit problems. Although simultaneous equations, matrixes, and determinants, are introduced in Chap. 6, they are defined and explained in some detail before actually being used. Similarly, the elements of trigonometry used with AC circuits are fully explained and illustrated with examples before being applied to AC circuit problems.

Chapters 1 through 6 of this text are devoted, in general, to the fundamentals of direct current, and Chaps. 8 through 13 focus on subjects usually associated with alternating current. This arrangement provides students with balanced coverage of basic concepts. The transition from direct current to alternating current through the study of magnetism and electromagnetism is distinct enough to allow use of the material in a traditional dc/ac sequence. However, all the material is structured to provide a unified introduction to the broad subject area called *electricity*.

## Chapter-by-Chapter Changes to This Edition

### Chapter 1

- Expanded the section on “efficiency” to include information on neon light bulbs and LEDs.

- Added a new EXAMPLE that examines the efficiency of a complete system (i.e., a battery and light bulb circuit). The new Self-Test question 11, and the answer to question 11 at the end of the chapter, follow up on working with system efficiency.
- Added new Self-Test and “Chapter Review” questions and problems.

### Chapter 2

- Changed the concluding paragraph of the “current in a vacuum” section to emphasize that devices that relied on thermionic emission and current in a vacuum have mostly been replaced by LCDs and solid-state devices.
- Added discussion of when to italicize a symbol (abbreviation) used in formulae.
- Added more EXAMPLES that show how to use “powers of 10.” EXAMPLE 2-9 shows how to express a base 10 number of less than one in the power-of-ten format. EXAMPLE 2-10 shows how to add, subtract, and divide numbers expressed in powers-of-ten. Also added Self-Test question 59 and its answer to give more practice on the procedures shown in the two added examples.
- Added new Self-Test and Chapter Review questions and problems.
- Added to chapter summary and review.

### Chapter 3

- Modified the section on Circuit Essentials.
- Clarified the discussion calculating power.
- Added more Chapter Review questions and problems.

### Chapter 4

- Added Self-Test and Chapter Review questions.
- Added a discussion on testing sealed lead-acid cells.
- Added a section on Fuel Cells.
- Added to the discussion of LEDs.
- Added an EXAMPLE for switch ratings.

## Chapter 5

- Added new EXAMPLES that:
  1. Require solving a series circuit containing a rheostat.
  2. Require determining the internal resistance of a battery.
  3. Require determining currents in a parallel circuit.
  4. Require determining the currents in a loaded zener-diode regulator circuit.
- Extended the discussion of “rules of thumb” for estimating current.
- Added material that illustrates the advantage of using the current divider formula.
- Added Chapter Review Problems.
- Added questions and problems to the *Experiments Manual* Chapter 5 test.

## Chapter 6

- Added a new EXAMPLE illustrating the use of simultaneous and loop equations.

## Chapter 7

- Added a new figure showing flux pattern around a MIG-arc-welder cable carrying 60 A to 120 A.
- Replaced three figures with new pictures to better show flux patterns under a variety of conditions.
- Added an EXAMPLE showing how to calculate relative permeability.
- Added more Chapter Review Problems.

## Chapter 8

- Added new EXAMPLES in the Three-Phase Alternating Current section.
- Added more Chapter Review Problems.

## Chapter 9

- Added more Chapter Review Problems.

## Chapter 10

- Expanded the introduction to the chapter to include use of large capacitors for PF correction.
- Added EXAMPLES emphasizing  $C$ ,  $V$ , and  $Q$  relationships and  $RC$  time constants.

## Chapter 11

- Added an EXAMPLE on calculating the inductance of an inductor.

- Expanded the section on “Type of Inductors.”
- Added the inductance formula to the “Related Formulas.”
- Added more Chapter Review Problems.

## Chapter 12

- Added EXAMPLES showing how to calculate coefficient of coupling, mutual inductance, and transformer ratings.
- Expanded discussion of transformer “Windings in Parallel.”
- Added formulas to “Related Formulas.”
- Added more Chapter Review Problems.

## Chapter 13

- Added to the discussion of EXAMPLE 13-5 to show other ways to calculate the  $\cos \theta$ .
- Added an EXAMPLE dealing with  $Z$  and  $BW$  of a series resonant circuit.
- Added more Chapter Review Problems.

## Chapter 14

- Added new EXAMPLES dealing with temperature rating of a motor and the  $R$  of a cable connecting to a motor.
- Expanded the discussion of reversing rotation of one-phase and three-phase motors.
- Added seven new problems to the Chapter Review Problems.

## Chapter 15

- Expanded the explanation of how a DMM measures current.
- Added an EXAMPLE dealing with ratings of meter movements.
- Expanded the discussion of sensitivity ratings of ac and dc voltmeters.
- Added more problems to the Chapter Review Problems.

## Chapter 16

- Re-emphasized the color and proper use of the neutral conductor.
- Added an EXAMPLE illustrating the current flow in each conductor when a short develops.
- Expanded the discussion on AFCI protection.

New MultiSim-11 files have been created and added for the chapters. The files are located on the CS-ROMs for

the textbook and the *Experiments Manual*, as well as on the Online Learning Center.

## Additional Resources

An *Experiments Manual* designed specifically for this textbook is available. It contains a comprehensive test, a wide variety of lab exercises and experiments, and additional problems for each chapter in the textbook. Some experiments must be done with physical (real) components, some must be done with electronic-circuit simulation software, and some can be done with either. MultiSim files are provided for those experiments that can be completed with simulation software. These files are located on the bound-in CD-ROM, along with a MultiSim Primer tutorial (written by Patrick Hoppe of Gateway Technical College) explaining how to get up and running with the program.

The *Student CD-ROM*, also provided with the textbook, provides MultiSim simulation files for many of the circuits in the textbook. They are arranged by chapter for easy reference.

The **Online Learning Center (OLC)** website (Student Center) provides extra review questions, links to industry sites, assignments, and tests. The student will also find the *Circuit Solver* program on the OLC. This program does not duplicate any of the typical simulation programs. It will help you select the value of a specific component

needed to provide the results you desire from a circuit you are designing.

The Instructor Center of the *OLC* provides a wide selection of information for the instructor. It contains the following features:

An Instructor's Manual that includes a list of the parts and equipment needed to perform lab experiments, Learning Outcomes for each chapter, answers to chapter review questions and problems, detailed instructions for seven projects, and more

- Twelve simulated instrumentation labs
- Instructor PowerPoint slide show for each chapter in the textbook. These shows use the student PowerPoint slides plus some instructional slides added to each chapter.
- Test generator software with a test bank for each chapter

## About the Author

Richard J. Fowler has spent four years in the USAF testing, repairing, and maintaining radio and navigation equipment. He has taught electricity and electronics for 30 years—one year in a public high school and 29 years in three universities. He has an Ed.D. from Texas A&M University (1965) and has published two textbooks, two laboratory manuals, and one chapter in a professional yearbook.