

second edition

ELECTRONIC CIRCUITS FOR TECHNICIANS



LLOYD TEMES

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FOR TECHNICIANS

second edition

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FOR TECHNICIANS

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To Roberta, Karen, Peter, and Lucy

PREFACE

Electronic Circuits for Technicians is written for use in two-year technical programs found in junior and community colleges and technical institutes. It provides for the training of engineering technicians. This text can also serve as a basis for a course for industrial arts and vocational teachers in a teachers' college setting.

Mathematical explanations are provided wherever pertinent. Since most of the literature an engineering technician is called upon to study is of a mathematical nature, the student should build an appreciation of such material and an ability to handle it. All mathematical explanations are presented with simple algebra and a bit of geometry. At no point in this text is calculus used. Thus, the only mathematics required of the student is what would normally be included in a high school course in intermediate algebra.

The student is expected to bring a knowledge of dc and ac circuitry to the course of study presented here. A basic knowledge of thermionic emission and the mechanics of operation of transistors will prove helpful. A course using a book such as *Basic Electronics*, Fourth Edition, by Grob (McGraw-Hill, 1977) would serve as an excellent prerequisite to this text, since it provides the fundamental background in devices and an intensive study of ac and dc circuit analysis. However, the student who has not had a background in thermionic emission or transistor physics will be able to master the material in this book since this text takes an engineering approach to the material.

While this revision continues the organization and approach that characterized the first edition, a number of other changes have been incorporated. All units, abbreviations, and symbols (especially the symbols for logic circuits found in Chapter 26) have been updated to reflect current standards. New exercise material has also been added at the end of many

chapters. In addition, Appendix B has been added in this second edition to provide either a review or introduction to the mechanics of solid-state devices.

Active devices are presented as components whose action is described by the characteristic curves and parameters supplied by the manufacturer. From the engineering point of view, it is sufficient to have a functional description of the device such as that provided by characteristic curves when circuits are designed or analyzed.

Vacuum tubes, transistors, and MOSFETs are presented side by side and are treated as special cases of the active device. In this age of rapid innovation, the student must develop a means of handling any device whose characteristics can be presented by a graph and/or parameters regardless of what the device is called.

In all parts of the text the material is constantly motivated by the design of better circuits for given functions. The reader is presented with enough background at each stage so that he or she can analyze and design working hardware.

Whenever a new concept or principle is introduced, a numerical illustrative problem is presented at that point, so that the student can see an immediate application. The text contains approximately 60 illustrative problems. If necessary, more than one illustrative problem is presented to show the similarity or dissimilarity of the different points of view. Many illustrative problems include a quick review by recalling all the information pertaining to a particular topic in a design. Each illustrative problem is designed to provide an example of the proper problem-solving technique. In many of the illustrative problems complete designs and analyses are performed.

The text is profusely illustrated, containing approximately 400 line drawings.

Wherever feasible, fundamental circuit theory is stressed. Throughout the text Thévenin's and Norton's theorems as well as Kirchhoff's two laws are constantly being emphasized. Whenever possible, these laws and theorems are recalled and applied.

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