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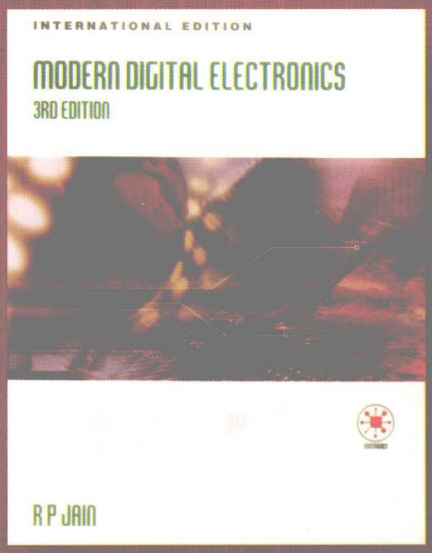

现代数字电子学

（第3版）

Modern Digital Electronics

(Third Edition)

R. P. Jain

清华大学出版社

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Modern Digital Electronics, Third Edition

影印版序

在教育部的倡导和推动下，许多高等学校都在电子技术课程的教学中开展了不同形式的双语教学试点工作。实践表明，采用双语教学是提高学生专业外语水平的一种有效途经。而能否找到一本合适的外语教材，将直接影响到教学效果，有时甚至会成为双语教学成败的关键。

就数字电子技术基础课程而言，这几年国内各家出版社引进的英语原版教材不下几十种，其中尤以美国的教材为多。由于国外电子技术课程的设置和内容的划分与我国的不完全相同，所以多数引进的英语教材在内容上与教育部主持制定的《数字电子技术课程教学基本要求》不完全吻合。主要表现在有些英语教材中缺少 A/D、D/A 转换和脉冲波形的产生和变换这两部分内容；有些教材只讲逻辑设计而对于电路的基础知识讲得过于简单，甚至根本不讲。此外这些英语教材的篇幅往往很大，容易使学生望而生畏。因此，用它们作数字电子技术基础课程的主教材都不够理想。

在这本由 R P Jain 编著的《Modern Digital Electronics》一书中则不存在上面所说的各种问题。将原书的第 13 章 Fundamentals of Microprocessors 略去以后，其内容完全符合《基本要求》所规定的内容，而且正文部分只有五百多页。该书内容精练，概念表述清晰，系统性强。无论是作为作数字电子技术课程双语教学的主教材，还是作为一般数字电子技术基础课程的外文参考书，该书的出版都为我们提供了一个更为理想的选择。

阎　石
清华大学自动化系
2007 年 5 月

PREFACE TO THE THIRD EDITION

The tremendous power and usefulness of digital techniques and systems can be seen from the wide variety of industrial machinery, computers, microprocessors, household appliances (washing machines, refrigerators, digital TVs, etc.), medical equipment, internet, e-banking, e-business, e-governance, etc. which are based on the principles of digital electronics. The areas of applications of digital electronics have been increasing day by day, resulting in an unprecedented interest in the subject. In fact, digital systems have invaded all walks of life that has created digital revolution.

One of the most important reason for the unprecedented growth of digital electronics is the advent of integrated circuits (ICs). Developments in the IC technology have made it possible to fabricate complex digital circuits, such as microprocessors, memories, complex programmable logic devices (CPLDs) and field programmable gate arrays (FPGAs), etc.

The wonderchip **microprocessor** has been the most fantastic development of the recent years. No other single development has affected our lives as much as the microprocessor in such a short time. Its ever-increasing applications have resulted in developments which were simply unheard of till a few years ago. The emergence of various programmable logic devices have resulted in significant changes in the design methodologies of digital systems. The designers of modern digital systems in industry rarely use conventional manual techniques. Instead, computer aided design (CAD) tools are used. But this has not made the basic concepts and the manual techiques of digital theory and practice obsolete. Rather, the manual techniques are the foundation of CAD tools and they provide a clear insight into the CAD tools. Therefore, it is very essential to have a strong foundation of the basic digital techniques for making effective use of automation in design.

This has made it imperative for all those who aspire to design, develop, test, and maintain various electronic systems to learn the principles of modern digital devices and systems.

The third edition of the book deals with the subject of digital techniques and systems from the basic circuits (gates) to small scale integrated circuits (SSI), medium scale integrated circuits (MSI), large scale integrated circuits (LSI), and very large scale integrated circuits (VLSI). Computer aided design concepts, CAD tools and hardware description language VHDL have been introduced to familiarize the readers with the CAD techniques.

This book is self contained and is suitable for a course in digital electronics and logic design for electrical, electronics, computer and other engineering disciplines and computer science programmes. Students of physics specializing in electronics will also find the book useful. For experimental work using SSI and MSI devices, the reader is advised to refer to Jain and Anand, *Digital Electronics Practice Using Integrated Circuits,* Tata McGraw-Hill, New Delhi, 1983.

The book has been systematically organized and the presentation has been kept at a level suitable for a student with the basic knowledge of circuit theory and electronics.

Chapter 1 introduces the fundamental concepts of digital electronics, advantages of digital systems, and the basic digital circuits. Various number systems and commonly used codes in digitial systems and microprocessors have been discussed in Chapter 2. Error-detecting and error-correcting codes have also been included in this edition. Chapter 3 reviews semiconductor devices from the point of view of their applications in digital circuits. Based on these devices, various digital circuits, referred to as logic families, have been discussed in Chapter 4. Availability of various digital functions in ICs have changed the teaching of digital electronics from the good old style using discrete devices to a new style using modern digital ICs. For example, now it is no more important to minimize the number of gates for the design of a digital circuit, since a number of similar gates are available in a single IC chip; rather it has become necessary to minimize the number of IC packages. Thus the designers of digital systems have to be thoroughly familiar with the principles of operation and flexibilities available in various ICs in order to optimize the design of digital systems from the point of view of cost, space, power requirement, speed of operation, etc. This chapter also deals with the interfacing problems between ICs of the same logic families and between those of different logic families to obtain maximum benefits.

Chapter 5 deals with the conventional methods of combinational circuit design. Quine-Mcluskey method has also been included in this edition.

Combinational logic design using MSI circuits is covered in Chapter 6, which is important for the design of digital systems considering the simplicity in design, cost, space, power requirement, speed and other factors.

Chapter 7 introduces the basic building block of a sequential circuit—the FLIP-FLOP. All types of FLIP-FLOPs with their excitation tables and triggering methods have been discussed in detail. Sequential logic design has been discussed in Chapter 8. Here again, both the approaches, namely conventional design using FLIP-FLOPs and the modern approach using available MSI circuits, have been discussed. Design of synchronous sequential as well as asynchronous sequential circuits have been discussed.

Chapter 9 deals with timing circuits and their applications which are essential to a digital system.

The analog-to-digital (A/D) and digital-to-analog (D/A) converters form an important part of many digital systems and the commonly used techniques for such conversions have been discussed in Chapter 10.

Chapter 11 deals with semiconductor memories which have assumed an important role in present-day digital systems. Various semiconductor memories, such as static and dynamic shift registers, static and dynamic RAMs, ROM, PROM, EPROM, EAROM, CAM, CCD, have been discussed in detail. Programming techniques used for programmable ROMs and erasing techniques used for erasable programmable ROMs have also been discussed.

Chapter 12 presents various programmable logic devices (PLDs), such as programmable logic arrays (PLA), programmable array logic (PAL), Complex Programmable logic devices (CPLDs) and field programmable gate array (FPGA) devices. These devices are extremely useful for the design of complex digital circuits.

Chapter 13 introduces computer aided design (CAD) approach to digital system design. CAD tools needed for this purpose have been discussed. The VHDL, a hardware description language has been introduced, which is the basic requirement of designing using CAD tools.

Glossary of the important terms used in the book and Review Questions with answers for each chapter have been included to enhance the understanding of the users.

The solution manual for the third edition is also available with the publishers, for the teachers who adopt this book.

R P JAIN

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