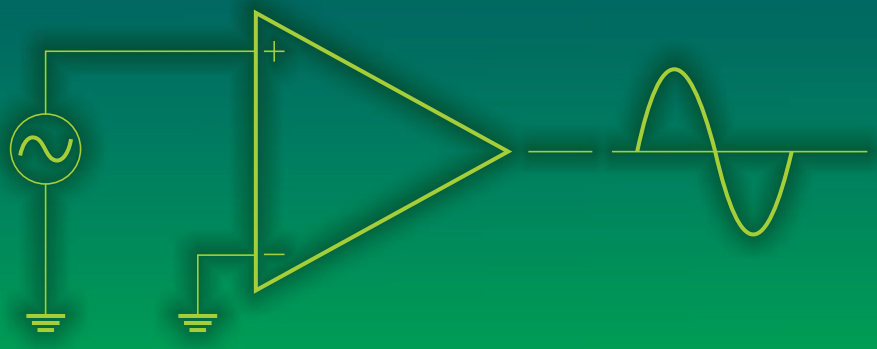
Eastern Economy Edition

Electronic Devices and Circuits



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Electronic Devices and Circuits

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ELECTRONIC DEVICES AND CIRCUITS
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Preface

This book is designed to be course-specific for the undergraduate students pursuing courses in Electronics and Electrical Engineering and its related disciplines. The topics are presented to meet the standards and syllabi of various universities.

The background material required for the study of the characteristics and applications of the electronic devices and circuits is covered in the first chapter. It includes introduction to semiconductors—both intrinsic and doped (extrinsic)—the concept of electrons and holes, drift and diffusion currents and *pn*-junction behaviour. The devices treated in Chapter 2 are diodes (including special purpose diodes), transistors—BJTs, JFETs, and MOSFETs—and also four-layered devices, i.e. thyristors. These chapters acquaint the students with theory, characteristics, and construction of the electronic devices covered. Chapter 3 contains the presentation of small-signal modelling of transistors, dc biasing of transistors, and some special circuits.

The circuitry and analysis of small signal amplifiers, power amplifiers, feedback amplifiers, and oscillators are covered in Chapters 4–6. The circuits of both types of transistors are treated together in each of these chapters. Operational amplifiers and their parameters, differential amplifiers, and their linear and nonlinear applications form the contents of Chapter 7.

Special circuits (multivibrators and switching regulators) and compound configurations of various kinds find a detailed treatment in Chapter 8. Chapter 9 is devoted to IC fabrication technology. A short but comprehensive presentation on circuit theory is offered in Chapter 10, primarily for quick reference or for teaching purposes where it forms part of the courseware. Finally, the concluding Chapter 11 offers a brief treatment of Cathode Ray Oscilloscope, so often required for practical measurements.

The treatment of the topics throughout is succinct, to the point, yet well-explained and rigorous.

The author acknowledges with thanks the efforts of the editorial and production teams of Prentice-Hall of India towards bringing out this book in excellent form.

The feedback from the readers towards improvement of the book will be gratefully acknowledged by the author.

I.J. NAGRATH

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Semiconductors, Diodes and Diode Circuits

1.1 INTRODUCTION TO ELECTRONICS

Electronics is a very wide field embracing almost all walks of human endeavour. In a way, electronics is the branch of electrical engineering which employs devices in which current flow is due to the controlled flow of charge carriers in a gas, in vacuum or in semiconductors. Electronic devices came into existence in the beginning of twentieth century. These devices used gaseous or vacuum medium for the flow of negatively charged particles, electrons. These devices were widely used for communications, controls and computers.

A major breakthrough was achieved in the field of electronics when it became possible to use semiconductors such as silicon and germanium for making electronic devices. The semiconductor devices are smaller, cheaper, more reliable and consume less power than the vacuum or the gaseous devices. Further developments in the semiconductor technology made it possible to integrate a large number of devices in a small silicon chip, known as *Integrated Circuit* (IC). Today, the number of devices on a chip has gone well beyond ten million. The integrated circuits have revolutionized the field of electronics and it will not be unrealistic to call the present age as the "electronics age". The impact of developments in electronics can be gauged from the availability of personal computers, which have tremendous capabilities as compared to computers in 1950s and 1960s, which occupied large space, consumed large power and costed millions of dollars. The major areas of application of electronics are communication, controls and computers, although it has invaded almost every field in our modern living.

1.2 TYPICAL ELECTRONIC SYSTEMS

As human beings, we are interested in communicating with people around us. If the persons with whom we want to have communication are closeby, such as in a small classroom, we can

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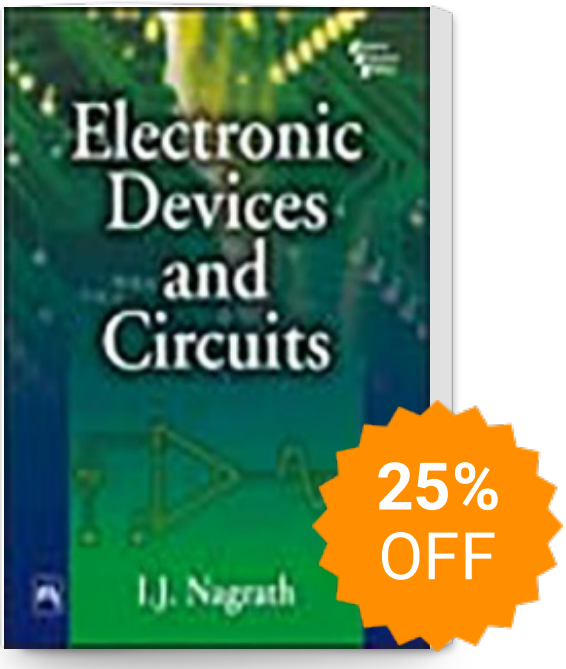

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