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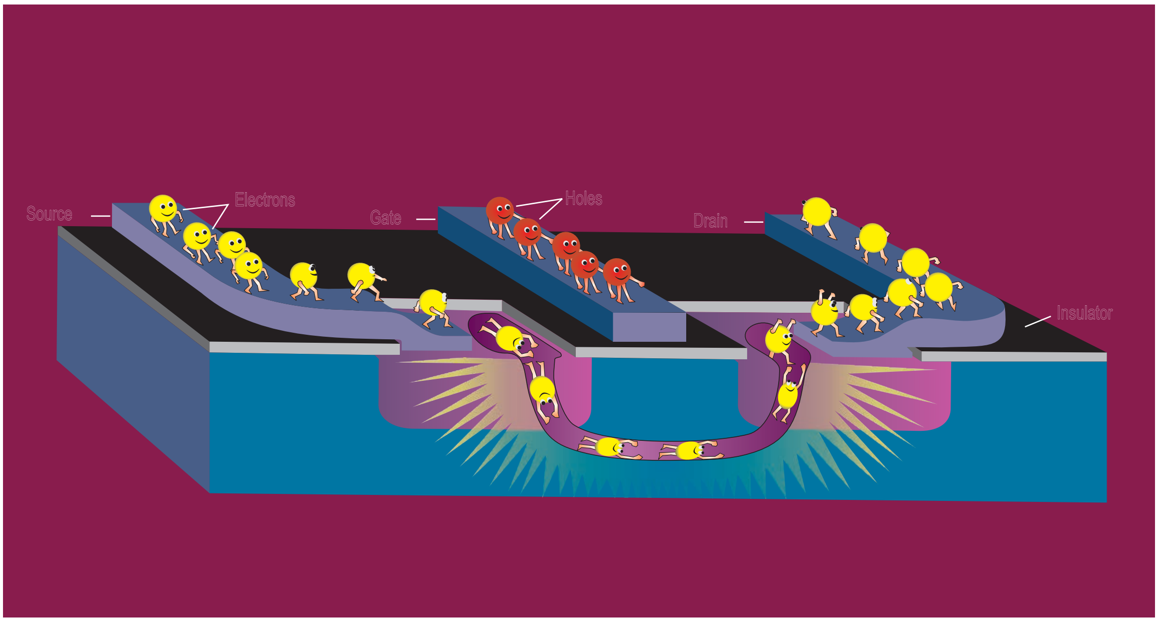
Semiconductor Devices

Modelling and Technology



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SEMICONDUCTOR DEVICES
Modelling and Technology

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PHI Learning Private Limited
New Delhi-110001
2011

SEMICONDUCTOR DEVICES: Modelling and Technology
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ISBN-978-81-203-2398-8

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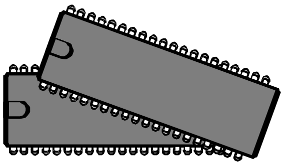
Seventh Printing ... ... October, 2011

Published by Asoke K. Ghosh, PHI Learning Private Limited, M-97, Connaught Circus, New Delhi-110001 and Printed by Raj Press, New Delhi-110012.

To
Our Parents



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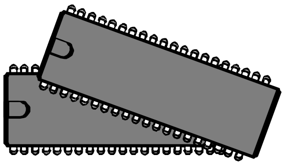

Preface

The Book

We have been teaching courses on Semiconductor Devices to undergraduate and postgraduate students for more than ten years. While teaching, we have observed that there are many excellent books, which discuss the physics of semiconductor devices in detail. On the other hand, there are also a number of good books which treat these devices simply as circuit elements and discuss the models commonly used for circuit simulation. However, since the analytical models are derived from the basic principles of the devices, engineering students should be able to correlate the two. This book aims at providing the students with the understanding of the basic operating principles of semiconductor devices and at the same time illustrates how the circuit models have been derived from these principles.

Another important aspect of this book is a brief but comprehensive discussion of device fabrication technology. The performance of modern day devices depends, to a great extent, on technological advances. This cannot be appreciated without an exposure to the various processing steps and so, it has been included in this book.

The first chapter discusses the basic properties of semiconductors and introduces the important parameters such as bandgap energy, mobility and lifetime of carriers which dictate the choice of material for a particular device application. Chapter 2 outlines the fabrication steps which have to be carried out in order to realize any device. Chapter 3 discusses the basic semiconductor equations. Chapters 4 to 11 discuss the operating principles of different semiconductor devices as well as their structure and also the different models used in circuit simulation for these devices. When a device is introduced, first the underlying principles and then the simpler models are discussed. This is followed by a discussion of the secondary effects. Along with that, more complex models have been introduced, which take these effects into account.

Target Audience

This book is targetted mainly for undergraduate students. However, for a first course of one semester (about 45 classes) chapters 5, 7, 8, and 11 may be omitted without any loss of continuity. These chapters deal with applications of diodes, advanced topics in BJT, thyristors, and advanced

Semiconductor Devices: Modelling And Technology

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ISBN : 9788120323988

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Type the URL : http://www.kopykitab.com/product/7436

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