Electronic and Optoelectronic Properties of Semiconductor Structures
Jasprit Singh
University of Michigan, Ann Arbor, USA

Presenting the underlying physics behind devices that drive today’s technologies. The book covers important details of structural properties, bandstructure, transport, optical and magnetic properties of semiconductor structures. Effects of low-dimensional physics and strain – two important driving forces in modern device technology – are also discussed. In addition to conventional semiconductor physics the book discusses self-assembled structures, mesoscopic structures and the developing field of spintronics. The book utilizes carefully chosen solved examples to convey important concepts and has over 250 figures and 200 homework exercises. Real-world applications are highlighted throughout the book, stressing the links between physical principles and actual devices. Electronic and Optoelectronic Properties of Semiconductor Structures provides engineering and physics students and practitioners with complete and coherent coverage of key modern semiconductor concepts. A solutions manual and set of viewgraphs for use in lectures are available for instructors, from solutions@cambridge.org.

Features
• Detailed and up-to-date coverage of the latest semiconductor devices, linking theoretical concepts with real-world applications
• Includes numerous worked examples and homework exercises


2003 554pp 288 illustrations 199 exercises
0 521 82379 X Hardback £37.50

Testing of Digital Systems
Niraj Jha
Princeton University, New Jersey, USA
Sandeep Gupta
University of Southern California, USA

Device testing represents the single largest manufacturing expense in the semiconductor industry, costing over US $40 billion a year. The most comprehensive and wide ranging book of its kind, Testing of Digital Systems covers everything you need to know about this vitally important subject. Starting right from the basics, the authors take the reader through automatic test pattern generation, design for testability and built-in self-test of digital circuits before moving on to more advanced topics such as IDDQ testing, functional testing, delay fault testing, memory testing, and fault diagnosis. The book includes detailed treatment of the latest techniques including test generation for various fault modes, discussion of testing techniques at different levels of integrated circuit hierarchy and a chapter on system-on-a-chip test synthesis.

Features
• Most comprehensive book yet on digital systems testing
• Covers all the latest techniques
• Includes System-on-a-Chip testing


2003 1016pp 559 illustrations
0 521 77356 3 Hardback £65.00
Optoelectronics
Emmanuel Rosencher
Ecole Polytechnique, Paris, France
Borge Vinter
Laboratoire Central de Recherches, France
Translated by P. G. Piva
A practical and self-contained graduate-level textbook on the subject, which will be of great value to both students and practising engineers. Sophisticated concepts are introduced in a practical and coherent way, including such topics as quantum mechanics of electron-photon interaction, quantisation of the electro-magnetic field and semiconductor properties. The book builds on these concepts to describe the physics, properties and performances of the main optoelectronic devices, and concludes by presenting the latest devices, including quantum well infrared photodetectors, quantum cascade lasers and optical frequency converters.

Features
• Self-contained textbook written for graduate students and engineers
• Includes coverage of the latest optoelectronic devices

Contents:
1. Quantum mechanics of the electron;
2. Quantum mechanics of the photon;
3. Quantum mechanics of the electron-photon interaction;
4. Laser oscillations;
5. Band structures of semiconductors;
6. Electronic properties of semiconductors;
7. Optical properties of semiconductors;
8. Semiconductor heterostructures and quantum wells;
9. Waveguides;
10. A few building blocks for semiconductor devices;
11. Semiconductor photodetectors;
12. Optical frequency conversion in semiconductors;
13. Light emitting diodes and laser diodes.

2002 744pp 590 illustrations
0 521 77129 3 Hardback £110.00
0 521 77813 1 Paperback £39.95

Fundamentals of Modern VLSI Devices
Yuan Taur and Tak H. Ning
Both from IBM T J Watson Research Center, New York, USA
This book examines in detail the basic properties and design, including chip integration, of CMOS and bipolar VLSI devices and discusses the various factors that affect their performance. It contains many exercises and can be used as a textbook for advanced undergraduate or beginning graduate courses on microelectronics or VLSI devices. With many industrially relevant examples it will be a valuable reference volume for practising research engineers in the electronics industry.

‘... well-written classroom text on VLSI devices ... this book will also prove valuable to practicing designers and researchers because of the many advanced topics included, covers a wide range of material for its size ... The book is logically organized. Both the ideas and the presentation are first-rate. The typesetting and diagrams are superb.’

COMPUTING REVIEWS

Contents:
1. Introduction;
2. Basic device physics;
3. MOSFET devices;
4. CMOS device design;
5. CMOS performance factors;
6. Bipolar devices;
7. Bipolar device design;
8. Bipolar performance factors; Appendices.

1998 496pp 243 illustrations
74 exercises
0 521 55056 4 Hardback £75.00
0 521 55959 6 Paperback £27.95

The Design of CMOS Radio-Frequency Integrated Circuits
Thomas H. Lee
Stanford University, USA
Wireless telecommunications has exploded onto the scene in the last couple of years, particularly with the increasing use of pagers and cell phones. Future wireless systems are expected to be built primarily of CMOS. This book sets out in detail how to design gigahertz-speed radio-frequency integrated circuits in CMOS technology. With over 350 circuit diagrams and illustrations, and many homework problems, this will be an ideal textbook for anyone taking advanced undergraduate or graduate courses in RF electronics, as well as a useful reference for practising engineers.

Features
• Very hot topic, basis of the huge wireless communications industry
• Comprehensive treatment of cutting-edge technology, with many devices described here for the first time


1998 616pp 376 illustrations
181 exercises
0 521 63922 0 Paperback £37.95
High-Speed Heterostructure Devices
From Device Concepts to Circuit Modeling
Patrick Roblin
Ohio State University, USA
Hans Rohdin
Hewlett-Packard Laboratories, Palo Alto, California, USA

High-speed heterostructures are spearheading the drive toward smaller, faster and lower power devices. Developed out of a graduate course taught at Ohio State University, this is a timely and comprehensive text on heterostructures, covering the physics, modeling techniques and the latest devices including MODFETs, HBTs and RTDs. Numerous homework exercises and a web link to MATLAB examples are included. The book will also be of great interest to researchers and engineers, since much of the research material has been gathered together and presented in book form for the first time.

Features
• Includes techniques for modeling and simulating the latest devices including MODFETs, HBTs and RTDs
• Web link to MATLAB models and simulations

2002 724pp 260 illustrations 0 521 78152 3 Hardback £60.00

Low-Dimensional Semiconductor Structures
Fundamentals and Device Applications
Edited by Keith Barnham and Dimitri Vvedensky
Both from Imperial College of Science, Technology and Medicine, London, UK

These days, the development of new semiconductor devices seems to be limited only by the imagination of the designer. This book provides a seamless, atoms-to-devices introduction to the latest quantum heterostructures. It covers their fabrication, their electronic, optical, and transport properties, their role in exploring new physical phenomena, and their utilisation in devices. It also contains many exercises and references. It is an ideal textbook for graduate-level courses in electrical engineering and applied physics and will also be of interest to engineers involved in the development of new semiconductor devices.

Features
• Describes all the key aspects of semiconductor heterostructures – fabrication, properties, and device applications
• Uses a clear 'atoms-to-devices' approach
• Contains a wealth of exercises and references

2001 408pp 275 illustrations 78 exercises 0 521 59103 1 Hardback £40.00

The Physics of Low-dimensional Semiconductors
An Introduction
John H. Davies
University of Glasgow, Scotland

Using simple physical explanations, this book introduces the general principles that underlie low-dimensional semiconductor heterostructures. The author describes the properties of two low-dimensional semiconductor systems in detail: the two-dimensional electron gas and the quantum well. The book will be invaluable to undergraduate and first-year graduate physics or electrical engineering students studying low-dimensional systems or heterostructure device physics.

Features
• Covers both electronic and optical properties, with reference to actual devices
• Strong appeal to both physics and electrical engineering audiences
• Complete with nearly 200 exercises and lots of examples taken from real applications

1998 456pp 180 illustrations 0 521 48491 X Paperback £27.95 0 521 48148 1 Hardback £75.00
The Physics of Semiconductors
With Applications to Optoelectronic Devices
Kevin F. Brennan
Georgia Institute of Technology, Atlanta, USA
Modern fabrication techniques have made it possible to produce semiconductor devices whose dimensions are so small that quantum mechanical effects dominate their behavior. This book describes the key elements of quantum mechanics, statistical mechanics, and solid-state physics that are necessary in understanding modern semiconductor devices. As well as covering theoretical results, the author describes many real devices. It contains many homework exercises and is suitable as a textbook for electrical engineering, materials science, or physics students taking courses in solid-state device physics.

‘…written professionally in a very competent and clear way. All problems are discussed correctly and presented in an interesting and comprehensive manner with reasonable use of mathematics for quantitative description. I hope that this book will be recognized as a good contribution to the literature of modern semiconductor physics books.’

EUROPEAN JOURNAL OF PHYSICS

Contents:
1. Basic concepts in quantum mechanics
2. One dimensional potential problems
3. Three dimensional potential problems
4. Approximation methods in quantum mechanics
5. Equilibrium statistical mechanics
6. Nonequilibrium statistical mechanics
7. Multielectron systems and crystalline symmetries
8. Motion of electrons in a periodic potential
9. Phonons and the electron-phonon interaction
10. Generation and recombination processes in semiconductors
11. Junctions
12. Semiconductor photonic detectors
13. Optoelectronic emitters
14. Field effect devices

Light-Emitting Diodes
E. Fred Schubert
Rensselaer Polytechnic Institute, New York, USA
Light emitting diodes (LEDs) are devices that are used in a myriad of applications, such as indicator lights in instruments, signage, illuminations, and communication. This graduate textbook reviews and discusses the underlying science and technology of this important class of semiconductor device and will be of interest to scientists and engineers working on LEDs, and to graduate students in electrical engineering, applied physics and materials science.

Features
• Comprehensive review of light-emitting diodes
• Includes material on applications
• Includes exercises and examples, so can be used as graduate textbook

Contents:
1. History of light-emitting diodes
2. Radiative and non-radiative recombination
3. Theory of radiative recombination
4. LED basics: electrical properties
5. LED basics: optical properties
6. High internal efficiency LED designs
7. High extraction efficiency structures
8. Visible-spectrum LEDs
9. Spontaneous emission from resonant cavities
10. Resonant cavity light-emitting diodes
11. Human vision
12. White-light LEDs
13. Optical communication
14. Communication LEDs
15. LED modulation characteristics
16. List of frequently used symbols
17. Appendix 1. List of frequently used symbols
18. Appendix 2. Physical constants
19. Appendix 3. Room temperature properties of semiconductors
20. Appendix 4. Periodic system of elements

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0 521 82330 7 Hardback £85.00
0 521 53351 1 Paperback £32.95

Mathematical Methods for Physics and Engineering
A Comprehensive Guide
2nd edition
K. F. Riley and M. P. Hobson
Both from University of Cambridge, UK and S. J. Bence
The new edition of this highly acclaimed textbook contains several major additions, including more than four hundred new exercises (with hints and answers). The authors have included a preliminary chapter covering areas such as polynomial equations, trigonometric identities, and coordinate geometry, as well as two separate chapters for statistics and probability.

Review from 1st edition
‘This is a valuable book with great potential use in present-day university physics courses. Furthermore, the book will be useful for graduate too, and researchers will find it useful for looking up material which they have forgotten since their undergraduate days.’

EUROPEAN JOURNAL OF PHYSICS

Contents
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5. Partial differentiation
6. Multiple integrals
7. Vector algebra
8. Matrices and vector spaces
9. Normal modes
10. Vector calculus
11. Line, surface and volume integrals
12. Fourier series
13. Integral transforms
14. First-order ordinary differential equations
15. Higher ordinary differential equations
16. Series solutions of ordinary differential equations
17. Eigenfunction methods for differential equations
18. Partial differential equations
19. Partial differential equations: general and particular
20. Partial differential equations: separation of variables and other methods
21. Complex variables
22. Calculus of variations
23. Integral equations
24. Group theory
25. Representation theory
26. Probability
27. Statistics
28. Numerical methods

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Quantum Heterostructures
Microelectronics and Optoelectronics
Vladimir Mitin
Wayne State University, Detroit, USA
Viacheslav Kochelap
National Academy of Sciences, Ukraine
and Michael A. Stroscio
Duke University, Durham, North Carolina, USA

Provides a detailed description of the key physical and engineering principles of quantum semiconductor heterostructures. Blending important concepts from physics, materials science, and electrical engineering, it also explains clearly the behaviour and operating features of modern microelectronic and optoelectronic devices.

Contents:
1. Trends in microelectronics and optoelectronics;
2. Theoretical basis of nanoelectronics;
3. Electrons in quantum structures;
4. Properties of particular quantum structures;
5. Lattice vibrations in quantum structures;
6. Electron scattering in quantum structures;
7. Parallel transport in quantum structures;
8. Perpendicular transport in quantum structures;
9. Electronic devices based on quantum heterostructures;
10. Optics of quantum structures;
11. Electro-optics and nonlinear optics;
12. Optical devices based on quantum structures.

1999 662pp 340 illustrations
48 exercises
0 521 63635 3 Paperback £32.95

Sub-Half-Micron Lithography for ULSIs
Edited by Katsumi Suzuki
NEC Corporation, Tsukuba, Japan
Shinji Matsui
Nano-scale Science and Technology Group, Himeji Institute of Technology, Japan
and Yukinori Ochiai
NEC Corporation, Tsukuba, Japan

In semiconductor-device fabrication processes, lithography technology is used to print circuit patterns on semiconductor wafers. The remarkable miniaturization of semiconductor devices has been made possible only because of the continuous progress in lithography technology. This book describes advanced techniques under development that represent the key to future semiconductor-device fabrication.

Contents:
1. Introduction;
2. Optical lithography;
3. X-ray lithography;
4. Electron beam lithography;
5. Ion beam lithography;
6. Resist;
7. Metrology, defect inspection and repair;
8. Summary.

2000 342pp 396 illustrations
0 521 57080 8 Hardback £80.00

Information is correct at time of going to press but is subject to change without prior notice.
Fundamentals of Carrier Transport

2nd edition

Mark Lundstrom
Purdue University, Indiana, USA

An accessible introduction to the behaviour of charged carriers in semiconductors and semiconductor devices. It is written specifically for engineers and students without an extensive background in quantum mechanics and solid-state physics. This second edition contains many new and updated sections, including a completely new chapter on transport in ultrasmall devices. It covers a range of essential physical principles and then goes on to cover both low- and high-field transport, scattering, transport in devices, and transport in mesoscopic systems. The use of Monte Carlo simulation methods is explained in detail.

Features
• Covers the behavior of the latest generation of ultrasmall devices
• Explains physical principles in ways that will be of practical help to device designers
• Gives step-by-step details of important derivations

Contents:

2000 464pp 171 illustrations 126 exercises 0 521 63134 3 Hardback £40.00

Silicon Micromachining

Miko Elwenspoek and Henri V. Jansen
Both from University of Twente, Enschede, The Netherlands

This comprehensive book provides an overview of the key techniques used in the fabrication of micron-scale structures in silicon. Recent advances in these techniques have made it possible to create a new generation of microsystem devices, such as microsensors accelerometers, micropumps, and miniature robots.

‘This book has many admirable properties. It covers the chosen subject in considerable detail and brings together much of the state-of-the-art. The illustrations and photographs are of very high quality and indeed the whole book is well presented.’

ENGINEERING SCIENCE AND EDUCATION JOURNAL

Contents:

1999 420pp 408 illustrations 33 exercises 0 521 59054 X Hardback £90.00

Plasma Processes for Semiconductor Fabrication

W. N. G. Hitchon
University of Wisconsin, USA

This self-contained book provides an up-to-date description of plasma etching and deposition in semiconductor fabrication. It presents the basic physics and chemistry of these processes, and shows how they can be accurately modelled. No prior knowledge of plasma physics is assumed in the book. It contains many exercises and will serve as an ideal introduction to plasma processing and technology.

Features
• Accessible introduction to an important technique in semiconductor manufacture
• Self-contained treatment
• Provides a glossary of technical terms

Contents:

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