

Elementary Semiconductor Physics

Fundamentals of Semiconductor Physics
Semiconductor Physics and Devices
Semiconductor Physics and Applications
Semiconductor Devices
Introduction to Semiconductor Physics
Fundamentals of Semiconductor Physics and Devices
The Physics of Semiconductor Devices
The Physics of Semiconductors
Introduction to Semiconductor Physics
Semiconductor Device Physics and Design
Physics of Semiconductor Devices
Introduction to Semiconductor Physics
Fundamentals of Semiconductors
Semiconductor Physics
Physics of Semiconductor Devices
Semiconductor Physics
Elementary Semiconductor Physics
Basic Semiconductor Physics
The Physics of Low-dimensional Semiconductors
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semiconductors have made an enormous impact on 20 th century science and technology this is because components made from semiconductors have very favorable properties such as low energy consumption compactness and high reliability and so they now dominate electronics and radio engineering semiconductors are indispensable for space exploration where the requirements of small size low weight and low energy consumption are especially stringent this book uses quantum mechanical concepts and band theory to present the theory of semiconductors in a comprehensible term it also describes how basic semiconductor devices eg diodes transistors and lasers operate the book was written for senior high school and b e b tech students interested in semiconductor physics

it is a pleasure to take the opportunity to express my sincere gratitude to many colleagues

who provided valuable hints for improvements even including lists of misprints which i hope have now been completely eliminated it is not possible to name all of them and so i will only mention the interesting discussions over so many years i had with professor hans w pötzl of the technical university of vienna on the occasion of our common weekly semiconductor seminar i am grateful to professor h j queisser and professor m cardona for helpful criticism special thanks are due to frau jitka fucik for typing and frau viktoría köver for drawing services the cooperation with dr h k lotsch of springer verlag has been a pleasure vienna january 1982 k seeger contents 1 elementary properties of semiconductors i 1 1 insulator semiconductor semimetal metal 1 1 2 the positive hole 3 1 3 conduction processes compensation law of mass action 4 problems 8 2 energy band structure 10 2 1 single and periodically repeated potential well 10 2 2 energy bands by tight binding of electrons to atoms 17 2 3 the brillouin zone 21 2 4 constant energy surfaces 30 problems 33 3 semiconductor statistics 34 3 1 fermi statistics 35 3 2 occupation probabilities of impurity levels 39 problems 45 4 charge and energy transport in a nondegenerate electron gas

neamen s semiconductor physics and devices third edition deals with the electrical properties and characteristics of semiconductor materials and devices the goal of this book is to bring together quantum mechanics the quantum theory of solids semiconductor material physics and semiconductor device physics in a clear and understandable way

the textbook combines a thorough theoretical treatment of the basic physics of semiconductors with applications to practical devices by putting special emphasis on the physical principles upon which these devices operate graduate students and lecturers in semiconductor physics condensed matter physics electromagnetic theory and quantum mechanics will find this a useful textbook and reference work jacket

this introductory text designed for the first course in semiconductor physics presents a well balanced coverage of semiconductor physics and device operation and shows how devices are optimized for applications the text begins with an exploration of the basic physical processes upon which all semiconductor devices diodes transistor light emitters and detectors are based topics such as bandstructure effective masses holes doping carrier transport and lifetimes are discussed next the author focuses on the operation of the important semiconductor devices along with issues relating to the optimization of device performance issues such as how doping device dimensions and parasitic effects influence device operation are also included the book is appropriate for the following courses device physics semiconductor devices device electronics physics of semiconductor devices integrated circuit devices device electronics solid state devices

this book is an introduction to the principles of semiconductor physics linking its scientific aspects with practical applications it is addressed to both readers who wish to learn semiconductor physics and those seeking to understand semiconductor devices it is particularly well suited for those who want to do both

semiconductor physics provides material for a comprehensive upper level undergraduate and graduate course on the subject guiding readers to the point where they can choose a special topic and begin supervised research the textbook provides a balance between essential aspects of solid state and semiconductor physics on the one hand and the principles of various semiconductor devices and their applications in electronic and photonic devices on the other it highlights many practical aspects of semiconductors such as alloys strain heterostructures nanostructures that are necessary in modern semiconductor research but typically omitted in textbooks for the interested reader some additional advanced topics are included such as bragg mirrors resonators polarized and magnetic semiconductors are included also supplied are explicit formulas in mathematical format for many results to support better understanding semiconductor physics requires little or no prior knowledge of solid state physics and aims to supply the clear and applied focus lacking in competing literature

this book covers the physics of semiconductors on an introductory level assuming that the reader already has some knowledge of condensed matter physics crystal structure band structure carrier transport phonons scattering processes and optical properties are presented for typical semiconductors such as silicon but iii v and ii vi compounds are also included in view of the increasing importance of wide gap semiconductors the electronic and optical properties of these materials are dealt with too

semiconductor device physics and design teaches readers how to approach device design from the point of view of someone who wants to improve devices and can see the opportunity and challenges it begins with coverage of basic physics concepts including the physics behind polar heterostructures and strained heterostructures the book then details the important devices ranging from p n diodes to bipolar and field effect devices by relating device design to device performance and then relating device needs to system use the student can see how device design works in the real world

excellent bridge between general solid state physics textbook and research articles packed with providing detailed explanations of the electronic vibrational transport and optical properties of semiconductors the most striking feature of the book is its modern outlook provides a wonderful foundation the most wonderful feature is its efficient style of exposition an excellent book physics today presents the theoretical derivations carefully and in detail and gives thorough discussions of the experimental results it presents this makes it an excellent textbook both for learners and for more experienced researchers wishing to check facts i have enjoyed reading it and strongly recommend it as a text for anyone working with semiconductors i know of no better text i am sure most semiconductor physicists will find this book useful and i recommend it to them contemporary physics offers much new material an extensive appendix about the important and by now well established deep center known as the dx center additional problems and the solutions to over fifty of the problems at the end of the various chapters

this book has been designed primarily as a text book for a three semester three hour per week senior or graduate course in semiconductor physics for students in electrical engineering and physics it may be supplemented by a solid state physics course prerequisites are courses in electrodynamics and for some of the chapters basic quantum mechanics emphasis has been laid on physical rather than technological aspects semiconductor physics is in fact an excellent and demanding training ground for a future physicist or electrical engineer giving him an opportunity to practice a large variety of physical laws he was introduced to in the more fundamental courses a detailed treatment of the transport and optical properties of semiconductor is given it was decided to omit the usual description of the material properties of certain semiconductors and instead to include the in between equations in mathematical derivations which i hope will make life simpler for a non theoretician in view of the many thousands of papers which appear every year in the field of semiconductor physics and which are distributed among more than 30 journals it would have been impossible for a single person to write comprehensive book unless there had not been some excellent review articles on special topics published in the series solid state physics festkorper probleme advances in solid state physics semiconductors and semimetals and progress in semiconductors and i have leaned heavily on such review articles

physics of semiconductor devices covers both basic classic topics such as energy band theory and the gradual channel model of the mosfet as well as advanced concepts and devices such as mosfet short channel effects low dimensional devices and single electron transistors concepts are introduced to the reader in a simple way often using comparisons to everyday life experiences such as simple fluid mechanics they are then explained in depth and mathematical developments are fully described physics of semiconductor devices contains a list of problems that can be used as homework assignments or can be solved in class to exemplify the theory many of these problems make use of matlab and are aimed at illustrating theoretical concepts in a graphical manner

this text brings together traditional solid state approaches from the 20th century with developments of the early part of the 21st century to reach an understanding of semiconductor physics in its multifaceted forms it reveals how an understanding of what happens within the material can lead to insights into what happens in its use

this book presents a detailed description of the basic physics of semiconductors all the important equations describing the properties of these materials are derived without the help of other textbooks the reader is assumed to have only a basic command of mathematics and some elementary semiconductor physics the text covers a wide range of important semiconductor phenomena from the simple to the advanced examples include recent progress in semiconductor quantum structures such as two dimensional electron gas systems ballistic transport the quantum hall effect the landauer formula the coulomb blockade and the single electron transistor

the composition of modern semiconductor heterostructures can be controlled precisely on the atomic scale to create low dimensional systems these systems have revolutionised semiconductor physics and their impact on technology particularly for semiconductor lasers and ultrafast transistors is widespread and burgeoning this book provides an introduction to the general principles that underlie low dimensional semiconductors as far as possible simple physical explanations are used with reference to examples from actual devices the author shows how beginning with fundamental results from quantum mechanics and solid state physics a formalism can be developed that describes the properties of low dimensional semiconductor systems among numerous examples two key systems are studied in detail the two dimensional electron gas employed in field effect transistors and the quantum well whose optical properties find application in lasers and other opto electronic devices the book includes many exercises and will be invaluable to undergraduate and first year graduate physics or electrical engineering students taking courses in low dimensional systems or heterostructure device physics

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