

Solid State And Semiconductor Physics By John Philip Mckelvey

Fundamentals of Semiconductor Physics
The Physics of Semiconductors
Semiconductor Physics and Devices
Semiconductor Physics and Applications
Physics of Semiconductor Devices
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Physics of Semiconductors and Nanostructures
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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

semiconductor devices are now a days common place in every household in the late 1940s the invention of the transistor was the start of a rapid development towards ever faster and smaller electronic components complex systems are built with these components the main driver of this development was the economical benefit from packing more and more wiring transistors and functionality on a single chip now every human is left with about 100 million transistors on average semiconductor devices have also enabled economically reasonable fiber based optical communication optical storage and high frequency amplification and have only recently revolutionized photography display technology and lighting along with these tremendous technological developments semiconductors have changed the way we work communicate entertain and think the technological sophistication of semiconductor materials and devices is progressing continuously with a large worldwide effort in human and monetary capital partly evolutionary partly revolutionary embracing the possibilities of nanotechnology for students semiconductors offer a rich

diverse and exciting field with a great tradition and a bright future this book is based on the two semester semiconductor physics course taught at university at Leipzig the material gives the students an overview of the subject as a whole and brings them to the point where they can specialize and enter supervised laboratory research for the interested reader some additional topics are included in the book that are taught in subsequent more specialized courses the first semester contains the fundamentals of semiconductor physics part I chaps 1-17

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

the new edition of the most detailed and comprehensive single volume reference on major semiconductor devices the fourth edition of physics of semiconductor devices remains the standard reference work on the fundamental physics and operational characteristics of all major bipolar unipolar special microwave and optoelectronic devices this fully updated and expanded edition includes approximately 1 000 references to original research papers and review articles more than 650 high quality technical illustrations and over two dozen tables of material parameters divided into five parts the text first provides a summary of semiconductor properties covering energy band carrier concentration and transport properties the second part surveys the basic building blocks of

semiconductor devices including p n junctions metal semiconductor contacts and metal insulator semiconductor mis capacitors part iii examines bipolar transistors mosfets mos field effect transistors and other field effect transistors such as jfets junction field effect transistors and mesfets metal semiconductor field effect transistors part iv focuses on negative resistance and power devices the book concludes with coverage of photonic devices and sensors including light emitting diodes leds solar cells and various photodetectors and semiconductor sensors this classic volume the standard textbook and reference in the field of semiconductor devices provides the practical foundation necessary for understanding the devices currently in use and evaluating the performance and limitations of future devices offers completely updated and revised information that reflects advances in device concepts performance and application features discussions of topics of contemporary interest such as applications of photonic devices that convert optical energy to electric energy includes numerous problem sets real world examples tables figures and illustrations several useful appendices and a detailed solutions manual for instructor s only explores new work on leading edge technologies such as modfets resonant tunneling diodes quantum cascade lasers single electron transistors real space transfer devices and mos controlled thyristors physics of semiconductor devices fourth edition is an indispensable resource for design engineers research scientists industrial and electronics engineering managers and graduate students in the field

provides a basis for understanding the characteristics operation and limitations of semiconductor devices this title deals with the electrical properties and characteristics of semiconductor materials and devices it intends to bring together quantum mechanics the quantum theory of solids and semiconductor material physics

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

this classroom tested textbook provides a self contained one semester course in semiconductor physics and devices that is ideal preparation for students to enter burgeoning quantum industries unlike other textbooks on semiconductor device physics it provides a brief but comprehensive introduction to quantum physics and statistical physics with derivations and explanations of the key facts that are suitable for second year undergraduates rather than simply postulating the main results the book is structured into three parts each of which can be covered in around ten lectures the first part covers fundamental background material such as quantum and statistical physics and elements of crystallography and band theory of solids since this provides a vital foundation for the rest of the text concepts are explained and derived in more detail than in comparable texts for example the concepts of measurement and collapse of the wave function which are typically omitted are presented in this text in language accessible to second year students the second part covers semiconductors in and out of equilibrium and gives details which are not commonly presented such as a derivation of the density of states using dimensional analysis and calculation of the concentration of ionized impurities from the grand canonical distribution special attention is paid to the solution of poisson s equation a topic that is feared by many undergraduates but is brought back down to earth by techniques and analogies from first year physics finally in the third part the material in parts 2 and 3 is applied to describe simple semiconductor devices including the mosfet the schottky and pn junction diodes and optoelectronic devices with a wide range of exercises this textbook is readily adoptable for an undergraduate course on semiconductor physics devices and with its emphasis on consolidating and applying knowledge of fundamental physics it will leave students in engineering and the physical sciences well prepared for a future where quantum industries proliferate

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

the purpose of this book is to provide the reader with a self contained treatment of fundamental solid state and semiconductor device physics the material presented in the text is based upon the lecture notes of a one year graduate course sequence taught by this author for many years in the department of electrical engineering of the university of florida it is intended as an introductory textbook for graduate students in electrical engineering however many students from other disciplines and backgrounds such as chemical engineering materials science and physics have also taken this course sequence and will be interested in the material presented herein this book may also serve as a general reference for device engineers in the semiconductor industry the present volume covers a wide variety of topics on basic solid state physics and physical principles of various semiconductor devices the main subjects covered include crystal structures lattice dynamics semiconductor statistics energy band theory excess carrier phenomena

and recombination mechanisms carrier transport and scattering mechanisms optical properties photoelectric effects metal semiconductor devices the p n junction diode bipolar junction transistor mos devices photonic devices quantum effect devices and high speed iii v semiconductor devices the text presents a unified and balanced treatment of the physics of semiconductor materials and devices it is intended to provide physicists and materials scientists with more device backgrounds and device engineers with a broader knowledge of fundamental solid state physics

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

this handbook gives a complete and detailed survey of the field of semiconductor physics it addresses every fundamental principle the most important research topics and results as well as conventional and emerging new areas of application additionally it provides all essential reference material on crystalline bulk low dimensional and amorphous semiconductors including valuable data on their optical transport and dynamic properties this updated and extended second edition includes essential coverage of rapidly advancing areas in semiconductor physics such as topological insulators quantum optics magnetic nanostructures and spintronic systems richly illustrated and authored by a duo of internationally acclaimed experts in solar energy and semiconductor physics this handbook delivers in depth treatment of the field reflecting a combined experience spanning several decades as both researchers and educators offering a unique perspective on many issues semiconductor physics is an invaluable reference for physicists materials scientists and engineers throughout academia and industry

quot an introduction to semiconductor devices by donald neamen is designed to provide a fundamental understanding of the characteristics operations and limitations of semiconductor devices in order to meet this goal the book brings together explanations of fundamental physics of semiconductor materials and semiconductor device physics this new text provides an accessible and modern approach to the material aimed at the undergraduate neamen keeps coverage of quantum mechanics to a minimum and labels the most advanced material as optional mos transistors are covered before bipolar transistors to reflect the dominance of mos coverage in today s world book jacket

this textbook presents a detailed description of basic semiconductor physics covering a wide range of important phenomena in semiconductors from simple to advanced it introduces and explains four different methods of energy band calculations in the full band region and covers fundamental topics such as the effective mass approximation and electron motion in a periodic potential the boltzmann transport equation and deformation potentials used for the analysis of transport properties the text also examines experimental and theoretical analyses of cyclotron resonance in detail and reviews essential optical and transport properties while covering optical transitions electron phonon interaction and electron mobility it presents numerical calculations of scattering rate relaxation time and mobility for typical semiconductors with bulk quantum well and hemt structures including wideband gap materials such as gan and sic in addition to iv and iii v semiconductors the updated fourth edition includes coverage of new topics such as surface modulated superlattices wannier stark effect bloch oscillation wide band gap semiconductors and photonic crystals featuring full color diagrams calculated with updated physical parameters as well as chapter end problems and solutions this tried and tested textbook on the basics of semiconductors physics is the cornerstone to any graduate or upper level undergraduate course on the subject

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

provides a modern introduction to semiconductor physics presenting the basic information necessary to understand semiconductors along with some of the latest theories and developments based on the author's undergraduate course this book bridges the gap between basic subjects such as quantum mechanics and Maxwell's equations and the fundamental processes determining the behaviour of semiconductors following a quantum mechanics approach this text is predominantly aimed at scientists rather than engineers and forms the basis for the understanding of modern mesoscopic physics in semiconductors and quantum devices like resonant tunneling diodes rather than attempting to comprehensively cover all aspects of semiconductor physics this text aims to cover the most important and interesting aspects of this subject to scientists starting with the development of semiconductor physics from basic quantum mechanics the text moves on to cover band structure and effective mass theory before covering electron phonon coupling and charge transport it concludes with a chapter on optical transitions students will need some knowledge of quantum mechanics and solid state although this is covered to some extent in the book features concise introduction to the basics of

semiconductor physics bridges the gap between fundamental subjects such as quantummechanics and maxwell s equations and the processes determining thebehaviour of semiconductors describes semiconductor theory from a full quantum mechanicalapproach an accessible introduction avoiding reliance on grouptheory contents preface notation conventions introduction electrons nuclei and hamiltonians band structure the k p approximation effective mass theory the crystal lattice electron phononcoupling charge transport optical transitions band electrons inan optical field appendix a the hydrogen atom appendix b theharmonic oscillator appendix c perturbation theory appendixd tensors in cubic crystals appendix e the classical limit appendix f some fourier transforms appendix g exercises bibliography

this textbook provides a theoretical background for contemporary trends in solid state theory and semiconductor device physics it discusses advanced methods of quantum mechanics and field theory and is therefore primarily intended for graduate students in theoretical and experimental physics who have already studied electrodynamics statistical physics and quantum mechanics it also relates solid state physics fundamentals to semiconductor device applications and includes auxiliary results from mathematics and quantum mechanics making the book useful also for graduate students in electrical engineering and material science key features explores concepts common in textbooks on semiconductors in addition to topics not included in similar books currently available on the market such as the topology of hilbert space in crystals contains the latest research and developments in the field written in an accessible yet rigorous manner

this book is a comprehensive text on the physics of semiconductors and nanostructures for a large spectrum of students at the final undergraduate level studying physics material science and electronics engineering it offers introductory and advanced courses on solid state and semiconductor physics on one hand and the physics of low dimensional semiconductor structures on the other in a single

text book key features presents basic concepts of quantum theory solid state physics semiconductors and quantum nanostructures such as quantum well quantum wire quantum dot and superlattice in depth description of semiconductor heterojunctions lattice strain and modulation doping technique covers transport in nanostructures under an electric and magnetic field with the topics quantized conductance coulomb blockade and integer and fractional quantum hall effect presents the optical processes in nanostructures under a magnetic field includes illustrative problems with hints for solutions in each chapter physics of semiconductors and nanostructures will be helpful to students initiating phd work in the field of semiconductor nanostructures and devices it follows a unique tutorial approach meeting the requirements of students who find learning the concepts difficult and want to study from a physical perspective

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Introduction

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