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The first true "introduction" to semiconductor optoelectronic devices, this book provides an accessible, well-organized overview of optoelectronic devices that emphasizes basic principles. Coverage begins with an optional review of key concepts— such as properties of compound semiconductor, quantum mechanics, semiconductor statistics, carrier transport properties, optical processes, and junction theory— then progress gradually

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through more advanced topics. The "Second Edition" has been both updated and expanded to include the recent developments in the field.

Optoelectronics has become an important part of our lives. Wherever light is used to transmit information, tiny semiconductor devices are needed to transfer electrical current into optical signals and vice versa. Examples include light emitting diodes in radios and other appliances, photodetectors in elevator doors and digital cameras, and laser diodes that transmit phone calls through glass fibers. Such optoelectronic devices take advantage of sophisticated interactions between electrons and light. Nanometer scale semiconductor structures are often at the

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heart of modern optoelectronic devices. Their shrinking size and increasing complexity make computer simulation an important tool to design better devices that meet ever rising performance requirements. The current need to apply advanced design software in optoelectronics follows the trend observed in the 1980's with simulation software for silicon devices. Today, software for technology computer-aided design (TCAD) and electronic design automation (EDA) represents a fundamental part of the silicon industry. In optoelectronics, advanced commercial device software has emerged recently and it is expected to play an increasingly important role in the near future. This book will enable students, device engineers, and researchers to more effectively use advanced design software in optoelectronics.

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Provides fundamental knowledge in semiconductor physics and in electromagnetics, while helping to understand and use advanced device simulation software Demonstrates the combination of measurements and simulations in order to obtain realistic results and provides data on all required material parameters Gives deep insight into the physics of state-of-the-art devices and helps to design and analyze of modern optoelectronic devices

The most up-to-date book available on the physics of photonic devices This new edition of Physics of Photonic Devices incorporates significant advancements in the field of photonics that have occurred since publication of the first edition (Physics of Optoelectronic Devices). New topics

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covered include a brief history of the invention of semiconductor lasers, the Lorentz dipole method and metal plasmas, matrix optics, surface plasma waveguides, optical ring resonators, integrated electroabsorption modulator-lasers, and solar cells. It also introduces exciting new fields of research such as: surface plasmonics and micro-ring resonators; the theory of optical gain and absorption in quantum dots and quantum wires and their applications in semiconductor lasers; and novel microcavity and photonic crystal lasers, quantum-cascade lasers, and GaN blue-green lasers within the context of advanced semiconductor lasers. Physics of Photonic Devices, Second Edition presents novel information that is not yet available in book form elsewhere. Many problem sets have been updated, the

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answers to which are available in an all-new Solutions Manual for instructors. Comprehensive, timely, and practical, Physics of Photonic Devices is an invaluable textbook for advanced undergraduate and graduate courses in photonics and an indispensable tool for researchers working in this rapidly growing field.

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

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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

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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.

Handbook of Optoelectronics offers a self-contained reference from the basic science and light sources to devices and modern applications across the entire spectrum of disciplines utilizing optoelectronic technologies. This second edition gives a complete update of the original work with a focus on systems and applications. Volume I covers

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the details of optoelectronic devices and techniques including semiconductor lasers, optical detectors and receivers, optical fiber devices, modulators, amplifiers, integrated optics, LEDs, and engineered optical materials with brand new chapters on silicon photonics, nanophotonics, and graphene optoelectronics. Volume II addresses the underlying system technologies enabling state-of-the-art communications, imaging, displays, sensing, data processing, energy conversion, and actuation. Volume III is brand new to this edition, focusing on applications in infrastructure, transport, security, surveillance, environmental monitoring, military, industrial, oil and gas, energy generation and distribution, medicine, and free space. No other resource in the field comes close to its

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breadth and depth, with contributions from leading industrial and academic institutions around the world. Whether used as a reference, research tool, or broad-based introduction to the field, the Handbook offers everything you need to get started. John P. Dakin, PhD, is professor (emeritus) at the Optoelectronics Research Centre, University of Southampton, UK. Robert G. W. Brown, PhD, is chief executive officer of the American Institute of Physics and an adjunct full professor in the Beckman Laser Institute and Medical Clinic at the University of California, Irvine.

Organized as a mini-encyclopedia of infrared optoelectronic applications, this long awaited new edition of an industry standard updates and expands on the groundbreaking work

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of its predecessor. Pioneering experts, responsible for many advancements in the field, provide engineers with a fundamental understanding of semiconductor physics and the technical information needed to design infrared optoelectronic devices. Fully revised to reflect current developments in the field, *Optoelectronics: Infrared-Visible-Ultraviolet Devices and Applications, Second Edition* reviews relevant semiconductor fundamentals, including device physics, from an optoelectronic industry perspective. This easy-reading text provides a practical engineering introduction to optoelectronic LEDs and silicon sensor technology for the infrared, visible, and ultraviolet portion of the electromagnetic spectrum. Utilizing a practical and efficient engineering approach throughout, the text

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supplies design engineers and technical management with quick and uncluttered access to the technical information needed to design new systems.

Reliability of Semiconductor Lasers and Optoelectronic Devices simplifies complex concepts of optoelectronics reliability with approachable introductory chapters and a focus on real-world applications. This book provides a brief look at the fundamentals of laser diodes, introduces reliability qualification, and then presents real-world case studies discussing the principles of reliability and what occurs when these rules are broken. Then this book

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comprehensively looks at optoelectronics devices and the defects that cause premature failure in them and how to control those defects. Key materials and devices are reviewed including silicon photonics, vertical-cavity surface-emitting lasers (VCSELs), InGaN LEDs and lasers, and AlGaIn LEDs, covering the majority of optoelectronic devices that we use in our everyday lives, powering the Internet, telecommunication, solid-state lighting, illuminators, and many other applications. This book features contributions from experts in industry and academia working in these areas and includes numerous practical examples and case studies. This book is suitable for new entrants to the field of optoelectronics working in R&D. • Includes case studies and numerous examples showing best practices and

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common mistakes affecting optoelectronics reliability
written by experts working in the industry • Features the first wide-ranging and comprehensive overview of fiber optics reliability engineering, covering all elements of the practice from building a reliability laboratory, qualifying new products, to improving reliability on mature products.

- Provides a look at the reliability issues and failure mechanisms for silicon photonics, VCSELs, InGaN LEDs and lasers, AlGaIn LEDs, and more.

Comprehensive coverage of organic electronics, including fundamental theory, basic properties, characterization methods, device physics, and future trends Organic semiconductor materials have vast commercial potential for

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a wide range of applications, from self-emitting OLED displays and solid-state lighting to plastic electronics and organic solar cells. As research in organic optoelectronic devices continues to expand at an unprecedented rate, organic semiconductors are being applied to flexible displays, biosensors, and other cost-effective green devices in ways not possible with conventional inorganic semiconductors. Organic Semiconductors for Optoelectronics is an up-to-date review of the both the fundamental theory and latest research and development advances in organic semiconductors. Featuring contributions from an international team of experts, this comprehensive volume covers basic properties of organic semiconductors, characterization techniques, device

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physics, and future trends in organic device development. Detailed chapters provide key information on the device physics of organic field-effect transistors, organic light-emitting diodes, organic solar cells, organic photosensors, and more. This authoritative resource: Provides a clear understanding of the optoelectronic properties of organic semiconductors and their influence to overall device performance Explains the theories behind relevant mechanisms in organic semiconducting materials and in organic devices Discusses current and future trends and challenges in the development of organic optoelectronic devices Reviews electronic properties, device mechanisms, and characterization techniques of organic semiconducting materials Covers theoretical concepts of optical properties

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of organic semiconductors including fluorescent, phosphorescent, and thermally-assisted delayed fluorescent emitters An important new addition to the Wiley Series in Materials for Electronic & Optoelectronic Applications, Organic Semiconductors for Optoelectronics bridges the gap between advanced books and undergraduate textbooks on semiconductor physics and solid-state physics. It is essential reading for academic researchers, graduate students, and industry professionals involved in organic electronics, materials science, thin film devices, and optoelectronics research and development.

The new edition of the most detailed and comprehensive single-volume reference on major semiconductor devices

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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-

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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

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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.

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