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Miniaturization and mass replications have begun to lead the optical industry in the transition from traditional analog to novel digital optics. As digital optics enter the realm of mainstream technology through the worldwide sale of consumer electronic devices, this timely book aims to present the topic of digital optics in a unified way. Ranging from micro-optics to nanophotonics, and design to fabrication through to integration in final products, it reviews the various physical implementations of digital optics in either micro-refractives, waveguide (planar lightwave chips), diffractive and hybrid optics or sub-wavelength structures (resonant gratings, surface plasmons, photonic crystals and metamaterials). Finally, it presents a comprehensive list of industrial and commercial applications that are taking advantage of the unique properties of digital optics. Applied Digital Optics is aimed primarily at optical engineers and product development and technical marketing managers; it is also of interest to graduate-level photonics students and micro-optic foundries. Helps optical engineers review and choose the appropriate software tools to design, model and generate fabrication files. Gives product managers access to an exhaustive list of applications available in today’s market for integrating such digital optics, as well as where the next potential application of digital optics might be. Provides a broad view for technical marketing managers in all aspects of digital optics, and how such optics can be classified. Explains the numerical implementation of optical design and modelling techniques. Enables micro-optics foundries to integrate the latest fabrication and replication techniques, and accordingly fine tune their own fabrication processes.
Optics and photonics technologies are ubiquitous: they are responsible for the displays on smart phones and computing devices, optical fiber that carries the information in the internet, advanced precision manufacturing, enhanced defense capabilities, and a plethora of medical diagnostics tools. The opportunities arising from optics and photonics offer the potential for even greater societal impact in the next few decades, including solar power generation and new efficient lighting that could transform the nation's energy landscape and new optical capabilities that will be essential to support the continued exponential growth of the Internet. As described in the National Research Council report Optics and Photonics: Essential Technologies for our Nation, it is critical for the United States to take advantage of these emerging optical technologies for creating new industries and generating job growth. The report assesses the current state of optical science and engineering in the United States and abroad--including market trends, workforce needs, and the impact of photonics on the national economy. It identifies the technological opportunities that have arisen from recent advances in, and applications of, optical science and engineering. The report also calls for improved management of U.S. public and private research and development resources, emphasizing the need for public policy that encourages adoption of a portfolio approach to investing in the wide and diverse opportunities now available within photonics. Optics and Photonics: Essential Technologies for our Nation is a useful overview not only for policymakers, such as decision-makers at relevant Federal agencies on the current state of optics and photonics research and applications but also for individuals seeking a broad understanding of the fields of optics and photonics in many arenas.
Photonic devices lie at the heart of the communications revolution, and have become a large and important part of the electronic engineering field, so much so that many colleges now treat this as a subject in its own right. With this in mind, the author has put together a unique textbook covering every major photonic device, and striking a careful balance between theoretical and practical concepts. The book assumes a basic knowledge of optics, semiconductors and electromagnetic waves. Many of the key background concepts are reviewed in the first chapter. Devices covered include optical fibers, couplers, electro-optic devices, magneto-optic devices, lasers and photodetectors. Problems are included at the end of each chapter and a solutions set is available. The book is ideal for senior undergraduate and graduate courses, but being device driven it is also an excellent engineers' reference.
The English edition is based upon the second edition of the German version of the book. The author would like to thank Mr. A.H. Armstrong for providing the basic English manuscript of the text, his critical reading, and valuable comments. Thanks are also due to Mrs. A. Demmer, Mr. J. Matern, Mrs. B. Titze and Mrs. S. Pfetsch for preparing the camera ready manuscript and the figures. Springer Verlag has generously supported the project and cooperating with them has been a great pleasure. Ulm, April 1992 K.J. Ebeling Preface to the First German Edition This book is a comprehensive introduction to waveguide optics and photonics in semiconductor crystals. Interest is centered on integrated optoelectronic devices for the transmission and processing of optical signals. These optical communi cations engineering devices are becoming increasingly important for optical disk storage systems, for optical chip-chip interconnections and of course for optical fiber transmission and exchange.

An introduction to photonics and lasers that does not rely oncomplex mathematics This book evolved from a series of courses developed by the authorand taught in the areas of lasers and photonics. This thoroughlyclassroom-tested work fills a unique need for students,instructors, and industry professionals in search of anintroductory-level book that covers a wide range of topics in theseareas. Comparable books tend to be aimed either too high or toolow, or they cover only a portion of the topics that are needed fora comprehensive treatment. Photonics and Lasers is divided into four parts: * Propagation of Light * Generation and Detection of Light * Laser Light * Light-Based Communication The author has ensured that complex mathematics does not become anobstacle to understanding key physical concepts. Physical argumentsand explanations are clearly set forth while, at the same time,sufficient mathematical detail is provided for a quantitativeunderstanding. As an additional aid to readers who are learning tothink symbolically, some equations are expressed in words as wellas symbols. Problem sets are provided throughout the book for readers to testtheir knowledge and grasp of key concepts. A solutions manual isalso available for instructors. Finally, the detailed bibliographyleads readers to in-depth explorations of particular topics. The book's topics, lasers and photonics, are often treatedseparately in other texts; however, the author skillfullydemonstrates their natural synergy. Because of the combinedcoverage, this text can be used for a two-semester course or aone-semester course emphasizing either lasers or photonics. This isa perfect introductory textbook for both undergraduate and graduatestudents, additionally serving as a practical reference forengineers in telecommunications, optics, and laser electronics.
This work addresses integrated optics from both the theory and practical modelling standpoints, describing recent work on beam propagation, planar spectrographs, four-wave coupled mode array, CAD for integrated optics and component cost modelling.
Since it was first published in 1995, Photonic Crystals has remained the definitive text for both undergraduates and researchers on photonic band-gap materials and their use in controlling the propagation of light. This newly expanded and revised edition covers the latest developments in the field, providing the most up-to-date, concise, and comprehensive book available on these novel materials and their applications. Starting from Maxwell's equations and Fourier analysis, the authors develop the theoretical tools of photonics using principles of linear algebra and symmetry, emphasizing analogies with traditional solid-state physics and quantum theory. They then investigate the unique phenomena that take place within photonic crystals at defect sites and surfaces, from one to three dimensions. This new edition includes entirely new chapters describing important hybrid structures that use band gaps or periodicity only in some directions: periodic waveguides, photonic-crystal slabs, and photonic-crystal fibers. The authors demonstrate how the capabilities of photonic crystals to localize light can be put to work in devices such as filters and splitters. A new appendix provides an overview of computational methods for electromagnetism. Existing chapters have been considerably updated and expanded to include many new three-dimensional photonic crystals, an extensive tutorial on device design using temporal coupled-mode theory, discussions of diffraction and refraction at crystal interfaces, and more. Richly illustrated and accessibly written, Photonic Crystals is an indispensable resource for students and researchers. Extensively revised and expanded Features improved graphics throughout Includes new chapters on photonic-crystal fibers and combined index-and band-gap-guiding Provides an introduction to coupled-mode theory as a powerful tool for device design Covers many new topics, including omnidirectional reflection, anomalous refraction and diffraction, computational photonics, and much more.
The field of integrated- or guided-wave optics has experienced significant and continuous growth since its inception in the late 1960s. There has been a considerable increase in research and development activity in this field worldwide and some significant advances in the realization of working in tegrated optic devices and modules have been made in recent years. In fact, there have already been some commercial manufacturing and technical ap plications of such devices and modules. The guided-wave-acoustooptics involving Bragg interactions between guided optical waves and surface acoustic waves is one of the areas of in tegrated-optics that has reached some degree of scientific and technological maturity. This topical volume is devoted to an in-depth treatment of this emerging branch of science and technology. Presented in this volume are concise treatments on bulk-wave acoustooptics, guided-wave optics, and surface acoustic waves, and detailed studies of guided-wave acoustooptic Bragg diffraction in three promising material substrates, namely, LiNb0 , 3 ZnO/Si0 , and GaAs, the resulting wide band modulators and deflectors, 2 and applications. The chapters cover not only the basic principles and the oretical analysis, but also the design, fabrication, and measurement of the resulting devices and modules, and their applications.

This graduate-level textbook presents the principles, design methods, simulation, and materials of photonic circuits. It provides state-of-the-art examples of silicon, indium phosphide, and other materials frequently used in these circuits, and includes a thorough discussion of all major types of devices. In addition, the book discusses the integrated photonic circuits (chips) that are currently increasingly employed on the international technology market in connection with short-range and long-range data communication. Featuring references from the latest research in the field, as well as chapter-end summaries and problem sets, Principles of Photonic Integrated Circuits is ideal for any graduate-level course on integrated photonics, or optical technology and communication.
From the beginning Integrated Photonics introduces numerical techniques for studying non-analytic structures. Most chapters have numerical problems designed for solution using a computational program such as Matlab or Mathematica. An entire chapter is devoted to one of the numeric simulation techniques being used in optoelectronic design (the Beam Propagation Method), and provides opportunity for students to explore some novel optical structures without too much effort. Small pieces of code are supplied where appropriate to get the reader started on the numeric work. Integrated Photonics is designed for the senior/first year graduate student, and requires a basic familiarity with electromagnetic waves, and the ability to solve differential equations with boundary conditions.
In recent years, photonics has found increasing applications in such areas as communications, signal processing, computing, sensing, display, printing, and energy transport. Now, Fundamentals of Photonics is the first self-contained introductory-level textbook to offer a thorough survey of this rapidly expanding area of engineering and applied physics. Featuring a logical blend of theory and applications, coverage includes detailed accounts of the primary theories of light, including ray optics, wave optics, electromagnetic optics, and photon optics, as well as the interaction of light with

matter, and the theory of semiconductor materials and their optical properties. Presented at increasing levels of complexity, these sections serve as building blocks for the treatment of more advanced topics, such as Fourier optics and holography, guidedwave and fiber optics, photon sources and detectors, electro-optic and acousto-optic devices, nonlinear optical devices, fiber-optic communications, and photonic switching and computing. Included are such vital topics as: Generation of coherent light by lasers, and incoherent light by luminescence sources such as light-emitting diodes Transmission of light through optical components (lenses, apertures, and imaging systems), waveguides, and fibers Modulation, switching, and scanning of light through the use of electrically, acoustically, and optically controlled devices Amplification and frequency conversion of light by the use of wave interactions in nonlinear materials Detection of light by means of semiconductor photodetectors Each chapter contains summaries, highlighted equations, problem sets and exercises, and selected reading lists. Examples of real systems are included to emphasize the concepts governing applications of current interest, and appendices summarize the properties of one- and two-dimensional Fourier transforms, linear-systems theory, and modes of linear systems. An Instructor's Manual presenting detailed solutions to all the problems in the book is available from the Wiley editorial department.

Updates the advancements made in the level of achievable integration of optical circuits and components in the last ten years--highlighting the commercial success of particular devices as well as introducing multiple facets of integrated optics.

The optical filter is resonator based. The required passband shape of ring resonator-filters can be custom designed by the use of configurations of various ring coupled resonators. This book describes the current state-of-the-art on these devices. It provides an in-depth knowledge of the simulation, fabrication and characterization of ring resonators for use as example filters, lasers, sensors.

Light and light based technologies have played an important role in transforming our lives via scientific contributions spanned over thousands of years. In this book we present a vast collection of articles on various aspects of light and its applications in the contemporary world at a popular or semi-popular level. These articles are written by the world authorities in their respective fields. This is therefore a rare volume where the world experts have come together to present the developments in this most important field of science in an almost pedagogical manner. This volume covers five aspects related to light. The first presents two articles, one on the history of the nature of light, and the other on the scientific achievements of Ibn-Haitham (Alhazen), who is broadly considered the father of modern optics. These are then followed by an article on ultrafast phenomena and the invisible world. The third part includes papers on specific sources of light, the discoveries of which have revolutionized optical technologies in our lifetime. They discuss the nature and the characteristics of lasers, Solid-state lighting based on the Light Emitting Diode (LED) technology, and finally modern electron optics and its relationship to the Muslim golden age in science. The book’s fourth part discusses various applications of optics and light in today's world, including biophotonics, art, optical communication, nanotechnology, the eye as an optical instrument, remote sensing, and optics in medicine. In turn, the last part focuses on quantum optics, a modern field that grew out of the interaction of light and matter. Topics addressed include atom optics, slow, stored and stationary light, optical tests of the foundation of physics, quantum mechanical properties of light fields carrying orbital angular momentum, quantum communication, and Wave-Particle dualism in action.

The Advanced Study Institute on Fiber and Integrated Optics was held at Cargese from June 23 to July 7, 1978, at a time when both fields were undergoing a very rapid evolution. Fiber optics communications systems, in a multimode form, are moving out of laboratories and into practical use, and integrated optics is beginning to produce high performance, single-mode devices. In addition, the spin-off from the technological developments in both fields is beginning to have a growing impact on the general field of experimental physics. The lectures given at Cargese and assembled here illustrate these points and will be of considerable interest to both newcomers and people already in these fields. The lectures in the first eight chapters of the book deal with fiber and optical communications. The second section, chapters 9-13, is devoted essentially to integrated optics. The third section, chapters 14-17, is devoted to technical seminars and the remaining chapters, 18-22, to national reviews and economic aspects of fiber systems. On behalf of the organizing committee, which included Drs. Unger, Arnaud, Scheggi, and Daino, I would like to thank the Scientific Affairs Division of NATO, and in particular its director, Dr. T. Kester, for enabling this Advanced Study Institute to be held. In addition, we would like to offer a very heartfelt thanks to Marie-France Hanseler, who, aided by Aline Medernach and G. Sala, created the memorable atmosphere that pervaded the Institute.

This book provides a comprehensive introduction to integrated optical waveguides for information technology and data communications. Integrated coverage ranges from advanced materials, fabrication, and characterization techniques to guidelines for design and simulation. A concluding chapter offers perspectives on likely future trends and challenges. The dramatic scaling down of feature sizes has driven exponential improvements in semiconductor productivity and performance in the past several decades. However, with the potential of gigascale integration, size reduction is approaching a physical limitation due to the negative impact on resistance and inductance of metal interconnects with current copper-trace based technology. Integrated optics provides a potentially lower-cost, higher performance alternative to electronics in optical communication systems. Optical interconnects, in which light can be generated, guided, modulated, amplified, and detected, can provide greater bandwidth, lower power consumption, decreased interconnect delays, resistance to electromagnetic interference, and reduced crosstalk when integrated into standard electronic circuits. Integrated waveguide optics represents a truly multidisciplinary field of science and engineering, with continued growth requiring new developments in modeling, further advances in materials science, and innovations in integration platforms. In addition, the processing and fabrication of these new devices must be optimized in conjunction with the development of accurate and precise characterization and testing methods. Students and professionals in materials science and engineering will find Advanced Materials for Integrated Optical Waveguides to be an invaluable reference for meeting these research and development goals.

The growing demand for instant and reliable communication means that photonic circuits are increasingly finding applications in optical communications systems. One of the prime candidates to provide satisfactory performance at low cost in the photonic circuit is silicon. Whilst silicon photonics is less well developed as compared to some other material technologies, it is poised to make a serious impact on the telecommunications industry, as well as in many other applications, as other technologies fail to meet the yield/performance/cost trade-offs. Following a sympathetic tutorial approach, this first book on silicon photonics provides a comprehensive overview of the technology. Silicon Photonics explains the concepts of the technology, taking the reader through the introductory principles, on to more complex building blocks of the optical circuit. Starting with the basics of waveguides and the properties peculiar to silicon, the book also features: Key design issues in optical circuits. Experimental methods. Evaluation techniques. Operation of waveguide based devices. Fabrication of silicon waveguide circuits. Evaluation of silicon photonic systems. Numerous worked examples, models and case studies. Silicon Photonics is an essential tool for photonics engineers and young professionals working in the optical network, optical communications and semiconductor industries. This book is also an invaluable reference and a potential main text to senior undergraduates and postgraduate students studying fibre optics, integrated optics, or optical network technology.

A complete basic undergraduate course in modern optics for students in physics, technology, and engineering. The first half deals with classical physical optics; the second, quantum nature of light. Solutions.

The Essence of Dielectric Waveguides provides an overview of the fundamental behavior of guided waves, essential to finding and interpreting the results of electromagnetic waveguide problems. Clearly and concisely written as well as brilliantly organized, this volume includes a detailed description of the fundamentals of electromagnetics, as well as a new discussion on boundary conditions and attenuation. It also covers the propagation characteristics of guided waves along classical canonical dielectric structures – planar, circular cylindrical, rectangular and elliptical waveguides. What’s more, the authors have included extensive coverage of inhomogeneous structures and approximate methods, as well as several powerful numerical approaches specifically applicable to dielectric waveguides.

The updated and enlarged new edition of this book provides an introduction to and an overview of semiconductor optics from the IR through the visible to the UV. It includes coverage of linear and nonlinear optical properties, dynamics, magneto- and electrooptics, high-excitation effects, some applications, experimental techniques and group theory. The mathematics is kept as elementary as possible. The subjects covered extend from physics to materials science and optoelectronics. New or updated chapters add coverage of current topics, while the chapters on bulk materials have been revised and updated.

Fundamentals of Optical Waveguides is an essential resource for any researcher, professional or student involved in optics and communications engineering. Any reader interested in designing or actively working with optical devices must have a firm grasp of the principles of lightwave propagation. Katsunari Okamoto has presented this difficult technology clearly and concisely with several illustrations and equations. Optical theory encompassed in this reference includes coupled mode theory, nonlinear optical effects, finite element method, beam propagation method, staircase concatenation method, along with several central theorems and formulas. Since the publication of the well-received first edition of this book, planar lightwave circuits and photonic crystal fibers have fully matured. With this second edition the advances of these fibers along with other improvements on existing optical technologies are completely detailed. This comprehensive volume enables readers to fully analyze, design and simulate optical atmospheres. Exceptional new chapter on Arrayed-Waveguide Grating (AWG) In-depth discussion of Photonic Crystal Fibers (PCFs) Thorough explanation of Multimode Interference Devices (MMI) Full coverage of polarization Mode Dispersion (PMD)

This book provides the first comprehensive, up-to-date and self-contained introduction to the emergent field of Programmable Integrated Photonics (PIP). It covers both theoretical and practical aspects, ranging from basic technologies and the building of photonic component blocks, to designalternatives and principles of complex programmable photonic circuits, their limiting factors, techniques for characterization and performance monitoring/-control, and their salient applications both in the classical as well as in the quantum information fields. The book concentrates and focusesmainly on the distinctive features of programmable photonics, as compared to more traditional ASPIC approaches.After some years during which the Application Specific Photonic Integrated Circuit (ASPIC) paradigm completely dominated the field of integrated optics, there has been an increasing interest in PIP. The rising interest in PIP is justified by the surge in a number of emerging applications that callfor true flexibility and reconfigurability, as well as low--cost, compact, and low-power consuming devices.Programmable Integrated Photonics is a new paradigm that aims at designing common integrated optical hardware configurations, which by suitable programming, can implement a variety of functionalities. These in turn can be exploited as basic operations in many application fields. Programmabilityenables, by means of external control signals, both chip reconfiguration for multifunction operation, as well as chip stabilization against non-ideal operations due to fluctuations in environmental conditions and fabrication errors. Programming also allows for the activation of parts of the chip,which are not essential for the implementation of a given functionality, but can be of help in reducing noise levels through the diversion of undesired reflections.

The book is inexpensive and algebra-based, suitable for post-secondary technical/vocational education. It deals with the physical concepts at the basic mathematical level for the technician student to succeed.

The great interest in photonic crystals and their applications in the last 15 years is being expressed in the publishing of a large number of monographs, collections, textbooks and tutorials, where existing knowledge concerning - eration principles of photonic crystal devices and microstructured ?bers, their mathematicaldescription,well-knownandnovelapplicationsofsuchtechno- gies in photonics and optical communications are presented. They challenges authors of new books to cover the gaps still existing in the literature and highlight and popularize of already known material in a new and original manner. Authorsofthisbookbelievethatthenextsteptowardswideapplicationofphotoniccrystalsisthesolutionofmanypracticalproblemsofdesignandc- putation of the speci?c photonic crystal-based devices aimed at the speci?c technicalapplication.Inordertomakethisstep,itisnecessarytoincreasethe number of practitioners who can solve such problems independently. The aim of this book is to extend the group of researchers, developers and students, who could practically use the knowledge on the physics of photonic crystals together with the knowledge and skills of independent calculation of basic characteristics of photonic crystals and modeling of various elements of - tegrated circuits and optical communication systems created on the basis of photonic crystals. The book is intended for quali?ed readers, specialists in the ?eld of optics and photonics, students of higher courses, master degree students and PhD students. As an introduction to the snopest, the book contains the basics of wave optics and radiation propagation in simple guiding media such as planar waveguides and step-index ?bers.

As optical technologies move closer to the core of modern computer architecture, there arise many challenges in building optical capabilities from the network to the motherboard. Rapid advances in integrated optics technologies are making this a reality. However, no comprehensive, up-to-date refer-

ence is available to the technologies and principles underlying the field. The Encyclopedic Handbook of Integrated Optics fills this void, collecting the work of 53 leading experts into a compilation of the most important concepts, phenomena, technologies, and terms covering all related fields. This unique book consists of two types of entries: the first is a detailed, full-length description; the other, a concise overview of the topic. Additionally, the coverage can be divided into four broad areas: A survey of the basics of integrated optics, exploring theory, practical concerns, and the fundamentals behind optical devices Focused discussion on devices and components such as arrayed waveguide grating, various types of lasers, optical amplifiers, and optoelectronic devices In-depth examination of subsystems including MEMS, optical pickup, and planar lightwave circuits Finally, systems considerations such as multiplexing, demultiplexing, 3R circuits, transmission, and reception Offering a broad and complete treatment of the field, the Encyclopedic Handbook of Integrated Optics is the complete guide to the fundamentals, principles, and applications of integrated optics technology.

Our intent in producing this book was to provide a text that would be comprehensive enough for an introductory course in integrated optics, yet concise enough in its mathematical derivations to be easily readable by a practicing engineer who desires an overview of the field. The response to the first edition has indeed been gratifying; unusually strong demand has caused it to be sold out during the initial year of publication, thus providing us with an early opportunity to produce this updated and improved second edition. This development is fortunate, because integrated optics is a very rapidly progressing field, with significant new research being regularly reported. Hence, a new chapter (Chap. 17) has been added to review recent progress and to provide numerous additional references to the relevant technical literature. Also, thirty-five new problems for practice have been included to supplement those at the ends of chapters in the first edition. Chapters I through 16 are essentially unchanged, except for brief updating revisions and corrections of typographical errors. Because of the time limitations imposed by the need to provide an uninterrupted supply of this book to those using it as a course text, it has been possible to include new references and to briefly describe recent developments only in Chapter 17. However, we hope to provide details of this continuing progress in a future edition.

This book covers the technology of switching or modulating light in semiconductor optical waveguides. Currently a key function for optical communications systems is the conversion of data from an electrical signal to an optical signal for transmission in very low loss optical fibres and the converse process of optical to electrical conversion the O/E/O data conversion. This conversion between electronic and photonic signals imposes an energy consumption overhead on optical communication systems. So many research workers have been attracted to ultrafast all-optical switching of data in different formats. As a way of introduction to all-optical switching in semiconductor waveguides the book covers the electro-optic effect, electroabsorption and electrorefraction; effects that can be used in semiconductor optical modulation devices. But the book focuses on all-optical switching using second and third order optical nonlinearities in AlGaAs optical waveguides. It covers a variety of device configurations including integrated nonlinear couplers and Mach-Zehnder interferometers. Further, it provides design software in suit of Mathematica notebooks that can be used to explore the device design.

Diode Lasers and Photonic Integrated Circuits, Second Edition provides a comprehensive treatment of optical communication technology, its principles and theory, treating students as well as experienced engineers to an in-depth exploration of this field. Diode lasers are still of significant importance in the areas of optical communication, storage, and sensing. Using the the same well received theoretical foundations of the first edition, the Second Edition now introduces timely updates in the technology and in focus of the book. After 15 years of development in the field, this book will offer brand new and updated material on GaN-based and quantum-dot lasers, photonic IC technology, detectors, modulators and SOAs, DVDs and storage, eye diagrams and BER concepts, and DFB lasers. Appendices will also be expanded to include quantum-dot issues and more on the relation between spontaneous emission and gain.

Fully revised and in its second edition, this standard reference on nano-optics is ideal for graduate students and researchers alike.

Since this book was first published in 1977, the major advances in optics have been the maturing of optical communications and the development of in tegrated optics. When I was offered the opportunity to prepare a revised edi tion, I decided to add chapters on these disciplines to the original work. This book, which was begun long before I joined the National Bureau of Stand ards, remains a private venture, written, so to speak, in my basement; there is no official connection with the National Bureau of Standards. I have also taken the opportunity to make some corrections and to add several short sections within the body of the earlier text. The most important of these changes include a discussion of group velocity, phase velocity and group index of refraction to anticipate the need for these concepts in Chap. 9; revision of the section on coherent-optical processing, including what is essen tially an optical derivation of the Fourier series; addition of the converging beam optical processor; and addition of a section on laser safety. The bulk of the new material comprises three chapters. The first is Chap. 9, "Optical Waveguides". In this chapter, I develop optical waveguide theory primarily on the basis of ray optics and interference in planar waveguides.

Develops the fundamental electromagnetic concepts and principles of guided wave optics from Maxwell's equations in a unified fashion. Analyzes many important building blocks of integrated optical systems. Discusses 2- and 3-dimensional optical waveguides, optical fibers, prism and dielectric waveguide couplers, waveguide filters, grating reflectors, and spectrum analyzers. The first introductory text to use optics rather than microwaves as a teaching vehicle, thus making the subject matter easily comprehensible. Numerous worked examples and homework problems included.

This book provides a cutting-edge research overview on the latest developments in the field of Optics and Photonics. All chapters are authored by the pioneers in their field and will cover the developments in Quantum Photonics, Optical properties of 2D Materials, Optical Sensors, Organic Opto-electronics, Nanophotonics, Metamaterials, Plasmonics, Quantum Cascade lasers, LEDs, Biophotonics and biomedical photonics and spectroscopy.

A classroom-tested introduction to integrated and fiber optics This text offers an in-depth treatment of integrated and fiber optics, providing graduate students, engineers, and scientists with a solid foundation of the principles, capabilities, uses, and limitations of guided-wave optic devices and systems. In addition to the transmission properties of dielectric waveguides and optical fibers, this book covers the principles of directional couplers, guided-wave gratings, arrayed-waveguide gratings, and fiber optic polarization components. The material is fully classroom-tested and carefully structured to help readers grasp concepts quickly and apply their knowledge to solving problems. Following an overview, including important nomenclature and notations, the text investigates three major topics: Integrated optics Fiber optics Pulse evolution and broadening in optical waveguides Each chapter starts with basic principles and gradually builds to more advanced concepts and applications. Compelling reasons for including each topic are given, detailed explanations of each concept are provided, and steps for each derivation are carefully set forth. Readers learn how to solve complex problems using physical concepts and simplified mathematics. Illustrations throughout the text aid in understanding key concepts, while problems at the end of each chapter test the readers' grasp of the material. The author has designed the text for upper-level undergraduates, graduate students in physics and electrical and computer engineering, and scientists. Each chapter is self-contained, enabling instructors to choose a subset of topics to match their particular course needs. Researchers and practitioners can also use the text as a self-study guide to gain a better understanding of photonic and fiber optic devices and systems.

In this newest edition of Optics and Lasers, I have added a substantial number of problems and moved most of the older ones to the end of the book. There are now about one hundred problems, which, I hope, will make the book more useful in the classroom. As before, some of the problems derive an espe cially important or useful result; these I have left integrated within the body of the book. In such cases, I state the result and, often, give it an equation number and a citation in the index. Teachers who adopt the book may obtain solutions to the problems by asking me for them on letterhead stationery. In addition, I have rewritten over a dozen paragraphs to improve their clarity or precision and, further , corrected minor errors of punctuation and taken care of other such small details. The field of optics has been changing greatly for almost two dozen years. Partly because of the applied or engineering nature of much of modern optics, there has been a need for a practical text that surveys the entire field. Such a book should not be a classical-optics text, but, rather , it should be strong on principles, applications and instrumentation, on lasers, holography and coherent light, and on optical-fiber waveguides. On the other hand, it should concern itself relatively little with such admittedly interesting phenomena as the formation of the rainbow or the precise determination of the speed of light.

This new, updated and enlarged edition of the successful and exceptionally well-structured textbook features new chapters on such hot topics as optical angular momentum, microscopy beyond the resolution limit, metamaterials, femtocombs, and quantum cascade lasers. It provides comprehensive and coherent coverage of fundamental optics, laser physics, and important modern applications, while equally including some traditional aspects for the first time, such as the Collins integral or solid immersion lenses. Written for newcomers to the topic who will benefit from the author's ability to explain difficult theories and effects in a straightforward and readily comprehensible way.

This hands-on introduction to silicon photonics engineering equips students with everything they need to begin creating foundry-ready designs.