

# ELEC6063 Optoelectronics and Lightwave Technology

## **Part 2: LEDs and lasers – 3 Optical Amplifiers & Photodetectors**

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ELEC 6063

Department of Electrical & Electronic Engineering, HKU



# Optoelectronics And Lightwave Technology

**Jianjun Gao**



## **Optoelectronics And Lightwave Technology:**

*Optoelectronics and Lightwave Technology* John E. Midwinter, Yili Guo, 1992      **Lightwave Technology** Govind P. Agrawal, 2004-06-02 A comprehensive treatise on the components and devices of the lightwave explosion Multiple advances in lightwave technology have led to a veritable overload of global information systems throughout the world Given the sheer number and growing importance of such systems Govind Agrawal's *Lightwave Technology* answers the need for a comprehensive and up to date account of all major aspects of this rapidly expanding field Components and Devices the first independent volume of this two volume engineering resource is devoted to describing a multitude of today's silica and semiconductor based optical devices Conceived and written by the foremost expert and bestselling author in the fiber optic field the text provides detailed in depth coverage of both theoretical and practical aspects of the science including Fiber optics Passive and active fiber components Planar waveguides Semiconductor lasers and amplifiers Optical modulators Photodetectors WDM components Space and time domain switching The second volume *Lightwave Technology Communication Systems* deals with the design and performance of modern transmission systems making use of these devices Complete with chapter problems a CD and a Solutions Manual this title serves as both a basic text book for students and a practical everyday reference for engineers and researchers in the field      Optoelectronic Technology and Lightwave Communications Systems Chinlon Lin, 2012-12-06 Ever since the invention of the transistor semiconductor based microelectronics has made a revolutionary impact on the information society as evident from the widespread application of microprocessor based technology in our modern society The next wave of modern information technology after transistors and microelectronics is that of lasers and micro optoelectronics Optoelectronics or optical electronics based on lasers and related modern optical technology has also become a very important field of science and technology in the past 20 years Electronics or microelectronics deals with micro electronic devices and components for generation transmission and processing of electronic signals In contrast in optoelectronics we deal with optoelectronic devices and components for the generation transmission and processing of lightwave signals It is the interaction of lightwaves photons with matter that shows the uniqueness of optoelectronic technology optical absorption and scattering optical gain and amplification material and waveguide dispersion nonlinear optical effects etc are very much dependent on the material's intrinsic properties and the lightwave propagation effects      Lightwave Technology Govind P. Agrawal, 2005-08-19 The state of the art of modern lightwave system design Recent advances in lightwave technology have led to an explosion of high speed global information systems throughout the world Responding to the growth of this exciting new technology *Lightwave Technology* provides a comprehensive and up to date account of the underlying theory development operation and management of these systems from the perspective of both physics and engineering The first independent volume of this two volume set *Components and Devices* deals with the multitude of silica and semiconductor based optical devices This second volume

Telecommunication Systems helps readers understand the design of modern lightwave systems with an emphasis on wavelength division multiplexing WDM systems. Two introductory chapters cover topics such as modulation formats and multiplexing techniques used to create optical bitstreams. Chapters 3 to 5 consider degradation of optical signals through loss dispersion and nonlinear impairment during transmission and its corresponding impact on system performance. Chapters 6 to 8 provide readers with strategies for managing degradation induced by amplifier noise, fiber dispersion and various nonlinear effects. Chapters 9 and 10 discuss the engineering issues involved in the design of WDM systems and optical networks. Each chapter includes problems that enable readers to engage and test their new knowledge to solve problems. A CD containing illuminating examples based on RSoft Design Group's award winning OptSim optical communication system simulation software is included with the book to assist readers in understanding design issues. Finally, extensive up to date references at the end of each chapter enable students and researchers to gather more information about the most recent technology breakthroughs and applications. With its extensive problem sets and straightforward writing style, this is an excellent textbook for upper level undergraduate and graduate students. Research scientists and engineers working in lightwave technology will use this text as a problem solving resource and a reference to additional research papers in the field.

**Integrated Optics and Optoelectronics** Frederick John Leonberger, 2000 *Lightwave Technology, 2 Volume Set* Govind P. Agrawal, 2006-12-22 Components and Devices provides a comprehensive account of the state of the art of lightwave technology and is devoted to active and passive components including a discussion of optical fibers, couplers, Bragg gratings, filters, interferometers, multiplexers and demultiplexers, waveguide grating routers, wavelength converters and optical switches. An attempt is made to include as much recent material as possible so that students are exposed to the recent advances in this exciting field. The reference list at the end of each chapter is more elaborate than what is common for a typical textbook. The listing of recent research papers should be useful for researchers using the book as a reference. A set of problems is included at the end of each chapter. Telecommunication Systems is devoted to the systems design issues with emphasis on WDM systems. It includes a discussion of the dispersive and nonlinear effects including polarization mode dispersion that affect the quality of the signal as it is transmitted through optical fibers. Other topics include receiver noise, loss dispersion and fiber nonlinearity management techniques and various system design issues relevant to modern WDM systems.

**Optoelectronic Integrated Circuit Design and Device Modeling** Jianjun Gao, 2011-09-19 In Optoelectronic Integrated Circuit Design and Device Modeling Professor Jianjun Gao introduces the fundamentals and modeling techniques of optoelectronic devices used in high speed optical transmission systems. Gao covers electronic circuit elements such as FET, HBT, MOSFET as well as design techniques for advanced optical transmitter and receiver front end circuits. The book includes an overview of optical communication systems and computer aided optoelectronic IC design before going over the basic concept of laser diodes. This is followed by modeling and parameter extraction techniques of lasers and photodiodes. Gao

covers high speed electronic semiconductor devices optical transmitter design and optical receiver design in the final three chapters Addresses a gap within the rapidly growing area of transmitter and receiver modeling in OEICs Explains diode physics before device modeling helping readers understand their equivalent circuit models Provides comprehensive explanations for E O and O E conversions done with laser and photodiodes Covers an extensive range of devices for high speed applications Accessible for students new to microwaves Presentation slides available for instructor use This book is primarily aimed at practicing engineers researchers and post graduates in the areas of RF microwaves IC design photonics and lasers and solid state devices The book is also a strong supplement for senior undergraduates taking courses in RF and microwaves Lecture materials for instructors available at [www.wiley.com/go/gao](http://www.wiley.com/go/gao)      **Fiber Optics Yellow Pages** ,

**Optoelectronics for Data Communication** Ronald C. Lasky,Ulf L. Osterberg,Daniel P. Stigliani,1995-10-23 The use of optoelectronics for data communication is becoming increasingly important in the 1990s Much of the base technology needed for this field was developed by the telecommunications industry but there are important differences which are covered in this text This is the first book to focus on the critical technology and application issues that are necessary to understand the optoelectronics for data communication industry which is expected to grow exponentially during the coming years Optoelectronics for Data Communication is an excellent reference for both researchers and engineers because it emphasizes fundamentals rather than more easily dated topics The book focuses particular attention on practical engineering issues making it invaluable to those who have worked or studied in the field of optoelectronics for telecommunication and are now moving to optoelectronics for data communication Focuses on fundamentals of the field Reviews critical technologies and applications Explains important technology compatibility issues Includes chapters written by specialists in each area with emphasis on engineering issues and practical aspects Presents coverage of topics that are unique to optical data communications      **Handbook of Optoelectronic Device Modeling and Simulation** Joachim Piprek,2017-10-10

Optoelectronic devices are now ubiquitous in our daily lives from light emitting diodes LEDs in many household appliances to solar cells for energy This handbook shows how we can probe the underlying and highly complex physical processes using modern mathematical models and numerical simulation for optoelectronic device design analysis and performance optimization It reflects the wide availability of powerful computers and advanced commercial software which have opened the door for non specialists to perform sophisticated modeling and simulation tasks The chapters comprise the know how of more than a hundred experts from all over the world The handbook is an ideal starting point for beginners but also gives experienced researchers the opportunity to renew and broaden their knowledge in this expanding field      *Introduction to Lightwave Communication Systems* Rajappa Papannareddy,1997 The promise of the on line communications revolution is widely acknowledged but not yet fulfilled Broader access to optical fiber systems holds the key to future success and their superior transmission capabilities will provide the true gateway to the information superhighway *Introduction to Lightwave*

Communication Systems covers the cutting edge of this critically important technology and provides an excellent technical grounding in the field     *Lightwave Technology* J. C. A. Chaimowicz, 1989 Originally appeared as Electro optics and applications in the publisher s catalog An intermediate title Introduction to lightwave technology is noted in CIP The final and correct title appears above Covers the basic techniques of generating modulating transmitting and receiving light carried information and such elements of geometrical optics which are indispensable for the understanding of optical communications opto electronic position sensing and insulated signal coupling Annotation copyrighted by Book News Inc Portland OR     **Optoelectronic Integrated Circuits** ,2001     Optoelectronic Interconnects ,1999     1995 SBMO/IEEE MTT-S International Microwave and Optoelectronics Conference Proceedings IEEE Microwave Theory and Techniques Society, 1995     **Fundamentals of Fibre Optics in Telecommunication and Sensor Systems** Bishnu P. Pal, 1992 Commences with the basics of fiber and integrated optics semiconductor sources and detectors fiber to fiber interconnection devices followed by their applications in telecommunication systems Introduces such emerging concepts as nonlinear guided wave optics solitons in fiber optics and electromagnetics of exotic fibers Lastly it describes several fiber optic devices and sensors which have become or will soon become commercial products for mass scale use in industry     **Optoelectronic Technology and LightWave Communications Systems** Chinlon Lin, 1989-06-29     **Optoelectronic Interconnects, Integrated Circuits, and Packaging** Louay A. Eldada, Randy A. Heyler, John R. Rowlette, 2002     **Optoelectronic Semiconductor Devices** David Wood, 1994 Optoelectronic Semiconductor Devices is a comprehensive new textbook offering a complete blend of theory and practice Starting with basic semiconductor theory it moves on through a discussion of light emitters and detectors and then to their actual manufacture Features of the book include full coverage of basic semiconductors and semiconductor lasers not seen in most optoelectronic textbooks of this level treatment of all types of detectors not just pin and avalanche diodes details of materials and fabrication and extensive references conceptual and numerical problems and worked examples Optoelectronic Semiconductor Devices can be used by undergraduate and postgraduate students in departments of physics or electrical engineering     **Optoelectronic Devices and Integration** ,2005

## Embracing the Beat of Phrase: An Emotional Symphony within **Optoelectronics And Lightwave Technology**

In some sort of eaten by monitors and the ceaseless chatter of instant transmission, the melodic splendor and mental symphony developed by the prepared word often fade in to the backdrop, eclipsed by the persistent noise and disturbances that permeate our lives. However, located within the pages of **Optoelectronics And Lightwave Technology** a stunning literary prize overflowing with fresh feelings, lies an immersive symphony waiting to be embraced. Constructed by an elegant musician of language, this fascinating masterpiece conducts readers on a mental trip, skillfully unraveling the hidden melodies and profound affect resonating within each carefully crafted phrase. Within the depths of the poignant examination, we can explore the book's main harmonies, analyze its enthralling publishing style, and surrender ourselves to the profound resonance that echoes in the depths of readers' souls.

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