

<b>Devi Ahilya University, Indore, India Institute of Engineering &amp; Technology</b>			<b>IV Year B.E. (Electronics and Telecommunication)</b>				
<b>Subject Code &amp; Name</b>	<b>Instructions Hours per Week</b>			<b>Credits</b>			
<b>ETR8C3 OPTICAL COMMUNICATION</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>
<b>Duration of Theory Paper: 3 Hours</b>	<b>3</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>1</b>	<b>1</b>	<b>5</b>

**Learning Objectives:** To understand fundamentals of optical communication system, its various elements, and optical networking

**Prerequisites:** Basic knowledge of electromagnetic theory

## COURSE CONTENTS

### UNIT-I

Introduction to optical fiber communication system, Advantages of optical fiber communication over conventional electrical communication, review of optical fiber fundamentals, ray theory transmission, electromagnetic mode theory for optical propagation in optical waveguides, Types of optical fibers: step index fibers, graded index fibers, single mode fibers etc., cut off wavelength

### UNIT-II

Transmission characteristics: fiber attenuation, absorption and scattering losses, fiber bend loss, fiber dispersion, intermodal and intra-modal dispersion, overall fiber dispersion, dispersion shifted fibers, dispersion flattened fibers, non-zero-dispersion shifted fibers, polarization maintaining fibers.

### UNIT-III

Optical sources: Lasers and LEDs: basic concepts, injection laser, characteristics, temperature dependence, dynamic response, noise, reliability, Optical detection principle, absorption, quantum efficiency, responsivity, large wavelength cut off, pin photodiode, avalanche photodiode, receiver: basic concepts and types of noise.

### UNIT-IV

Optical networks: Basic principles and components, couplers, isolators, circulators, multiplexers: gratings, Fabry perot filters, multilayer dielectrics, Mach-Zehnder interferometer, Acousto-optic tunable filters, Optical amplifiers-Semiconductor optical amplifiers, Erbium doped fiber amplifiers, wavelength converters, optical switches, optical add-drop multiplexers

### UNIT-V

Optical networks: architecture, Synchronous optical network/ synchronous digital hierarchy- elements, multiplexing, layers, frame structure, WDM network architectures, broadcast and select networks,

wavelength routed networks, routing and wavelength assignment (RWA), access networks, Optical OFDM, Flexible optical networks

### **Learning Outcomes:**

Upon completing the course, students will be well versed with the fundamental concepts of optical communication, and will be able to contribute to the current and upcoming advances in the technology.

### **BOOKS RECOMMENDED:**

- [1] John M Senior, Optical fiber Communication: Principles and Practice, Pearson Education - 2006
- [2] Gerd Keiser, Optical fiber communication, Fifth Edition McGraw Hill Education (India), 2013
- [3] Rajiv Ramaswami and Kumar N. Sivarajan, "Optical Networks : A Practical Perspective", Harcourt Asia Pte Ltd., Second Edition 2004.
- [4] C. Siva Ram Moorthy and Mohan Gurusamy, "WDM Optical Networks : Concept, Design and Algorithms", Prentice Hall of India, 1st Edition, 2002

### **List of Practical Assignments:**

- 1) To set-up a fiber optic analog link
- 2) To set up a fiber optical digital link
- 3) To obtain intensity modulation of an analog signal, transmit it over a fiber cable and demodulate it at the receiver and to get back original signal
- 4) To obtain intensity modulation of a digital signal, transmit it over a fiber cable and demodulate it at the receiver and to get back original signal
- 5) To study the frequency modulation in case of fiber optic communication system.
- 6) To undertake the pulse width modulation in case of fiber optic communication system.
- 7) To determine the propagation losses in case of optical fiber communication system.
- 8) To evaluate bending losses in case of optical fiber communication system.
- 9) To determine the numerical aperture of an optical fiber
- 10) To study the characteristics of frequency modulation in case of fiber optic communication system.
- 11) To plot the electrical to optical conversion characteristics