Devi Ahilya University, Indore, India Institute of Engineering & Technology				**IV Year B.E. (Electronics and Telecommunication Engg.)**			
Subject Code & Name	**Instructions Hours per Week**			**Credits**			
8ETRC3 OPTICAL COMMUNICATION	**L**	**T**	**P**	**L**	**T**	**P**	**Total**
	3	**1**	**2**	**3**	**1**	**1**	**5**
Duration of Theory Paper: 3 Hours							

Course Learning Objectives:

- To learn about the evolution of optical communication systems.
- To develop fundamentals of optical fiber communication system, the transmission characteristics and the signal impairments.
- To understand various kinds of sources, detection mechanisms, and the underlying components and technologies.
- To understand basic principles of optical networking, various components, configurations and the system.
- To understand aspects and challenges related to all-optical networks, SONET/SDH operational principles, wavelength routed networks, Fi-Wi access networks, Quantum secure networks

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, Multicore Fibres, Quantum secure networks

Course Outcomes:

Students earned credits will develop understanding about

CO. No.	CO	PO
CO1	Propagation of electromagnetic wave in dielectric media	PO1, PO2
CO2	Transmission characteristics of optical fibers	PO2
CO3	Structure, characteristics and use of optical sources, detectors, other components and associated electronics.	PO3, PO4, PO5
CO4	Functioning, structure and design aspects of various elements of the optical networking domain, comparison of various technologies	PO7, PO9
CO5	Architecture of all optical networking and future trends, Practical aspects, use of sustainable technologies	PO10, PO11, PO12, PO8

CO-PO Relationship:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3										
CO2		3										
CO3			1	3	3							
CO4							3	2	2			
CO5										3	2	3

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, Ist 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