OPTICAL COMMUNICATION

VIII Semester: ECE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AEC018	Core	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Understand the different kind of losses, signal distortion in optical wave guides and other signal degradation factors.Design optimization of SM fibers, RI profile and cut-off wave length. .

II. Interpret various optical source materials, LED structures, quantum efficiency, Laser diodes and different fiber amplifiers.

III. Understand fiber optical receivers such as PIN APD diodes, noise performance in photo detector, receiver operation and configuration.

IV. Analyze fiber slicing and connectors, noise effects on system performance, operational principles WDM and solutions.

COURSE OUTCOMES (COs):

CO 1: Overview Of Optical Fiber Communication, Vector Nature Of light, types of optical fibers, modal analysis.

CO 2: Understand Signal Degradation And Optical Sources, Attenuation- Absorption, Material Dispersion, Optical sources, Principles of operation.

CO 3: Understand Optical Detectors, Optical Erectors, Sensitivity And Quantum Efficiency, WDM Concepts And Components,

CO 4: Understand Optical Amplifiers, Basic concepts, semiconductor amplifier, principles of operation, intermediation effects,

CO 5: Understand Optical Networks And Dispersion Compensation, Optical networks, soliton based communication system design.

COURSE LEARNING OUTCOMES (CLOs):

1. Understand Basic principles of optical fiber Communications. Visualize modeling principles scope, decision making, general methods for solving OR models.
2. Define light, propagation of light, modes, propagation of light different levels..
3. Given the propagation of light in a cylindrical dielectric rod; rays and modes types of optical fibers.
4. Given the Photonic components in optical communication systems.
5. Understand modal analysis of a step index fiber, linearly polarized modes, single mode fibers and graded - index fiber.
6. Understand Signal Degradation And Optical Sources, Attenuation- Absorption, scattering losses, bending losses, core.
7. Explain cladding losses, optical waveguides; Material Dispersion, Waveguide Dispersion; Optical sources.
8. Explain Semiconductor device fabrication, LED and LASER diode; Principles of operation, concepts of line width.
9. Understand phase noise, switching and modulation characteristics.
10. Define Optical detectors: pin detector, avalanche photodiode.
11. Understand Principles of operation, concepts of responsively, sensitivity and quantum efficiency, noise in detection.
12. Explain Multichannel Transmission Technique-Multichannel Frequency Modulation, Subcarrier multiplexing. WDM Concepts and Components.
13. Understand semiconductor amplifier, erbium-doped fiber amplifier, Raman amplifier, Brillouin amplifier.
14. Understand principles of operation, amplifier noise, signal to noise ratio, gain, gain bandwidth, gain.
15. Explain noise dependencies, inter modulation effects, saturation induced crosstalk, wavelength range of operation.
16. Design Optical networks-SONET/SDH, ATM, IP, wavelength routed networks, soliton communication system.
17. Understand Fiber soliton, soliton based communication system design, high capacity and WDM soliton.

UNIT - I	OVERVIEW OF OPTICAL FIBRE COMMUNICATION	Classes: 10

overview : Introduction to vector nature of light, propagation of light, propagation of light in a cylindrical dielectric rod; rays and modes; different types of optical fibers, modal analysis of a step index fiber, linearly polarized modes, single mode fibers and graded - index fiber.

UNIT - II	SIGNAL DEGRADATION AND OPTICAL SOURCES	Classes: 09

Attenuation- Absorption, scattering losses, bending losses, core and cladding losses; signal distortion in optical waveguides; Material Dispersion, Waveguide Dispersion; Optical sources; Semiconductor device fabrication, LED and LASER diode; Principles of operation, concepts of line width, phase noise, switching and modulation characteristics.

UNIT - III	OPTICAL DETECTORS	Classes: 08

Optical detectors: pin detector, avalanche photodiode - Principles of operation, concepts of responsively, sensitivity and quantum efficiency, noise in detection.

Multichannel Transmission Technique-Multichannel Frequency Modulation, Subcarrier multiplexing. WDM Concepts and Components.

UNIT - IV	OPTICAL AMPLIFIERS	Classes: 08

Basic concepts: semiconductor amplifier, erbium-doped fiber amplifier, Raman amplifier, Brillouin amplifier - principles of operation, amplifier noise, signal to noise ratio, gain, gain bandwidth, gain and noise dependencies, inter modulation effects, saturation induced crosstalk, wavelength range of operation.

UNIT -V	OPTICAL NETWORKS AND DISPERSION COMPENSATION	Classes: 10

Optical networks: SONET/SDH, ATM, IP, wavelength routed networks, soliton communication system, fiber soliton, soliton based communication system design, high capacity and WDM soliton.

Text Books:

1. Keiser. G, ―Optical fiber communications‖, Tata McGraw-Hill, 4th Edition, New Delhi, 2008.
2. Agrawal. G.P, ―Fiber-Optic Communication Systems‖ John Wiley & Sons, 3rd Edition,2002

Reference Books:

1. John Gowar, "Optical Communication Systems", Prentice Hall, 2nd Edition, 1993.
2. Franz, Jain, "Optical communication, Systems and Components", Narosa Publications, 1st Edition New Delhi, 2000.
3. Karminvov, T. Li "Optical Fibre Telecommunications", Vol A & B, Academic Press, 2002.

Web References:

1. http://nptel.ac.in
2.http://nptel.ac.in/courses
3.https://onlinecourses.nptel.ac.in

E-Text Books:

1.https://eceagmr.files.wordpress.com

2.http://www.slac.stanford.edu

3.https://www.utdallas.edu