

3EC45: OPTICAL FIBER COMMUNICATION
CREDITS - 3 (LTP: 3,0,0)

Course Objective:

To familiarize students with the propagation of light signal through optical fibers, the power penalty in a link, fiber amplifiers, coupling of power to optical fibers and losses, etc.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE	CE	ESE	CE	100	
3	0	0	3	60	40	00		00

Course Content:

Unit No.	Topics	Teaching Hours
1.	Basic principles of light propagation : Electromagnetic Spectrum, Optical Spectral Bands, Evolution of Fiber Optic System, Elements of Optical Fiber Transmission Link. Nature of Light, Basic Optical Laws, Propagation of Light in Fiber, Wavelengths, Optical Power, Types of Optical Fiber, Fiber Fabrication, Fiber Cables.	12
2.	Optical signal distortion : Attenuation , Fiber Losses , Signal Distortion in Optical Waveguide, Pulse Broadening in Graded Index Fiber, Mode Coupling.	06
3.	Optical sources : Light Emitting Diode (LEDs)-Structures, Materials, Figure of Merits, Characteristics & Modulation, LASER Diodes -Modes & Threshold Conditions, Resonant Frequencies, Structures, Characteristics and Figure of Merits, Single-Mode LASER, Modulation of Laser Diodes. Source To Fiber Power Launching, Lensing Schemes, Fiber To Fiber Joints, Connectors, Splicing.	06
4.	Receiver systems : Principles of Operation, Types, Characteristics, Figure of Merits of Detectors Photodiode Materials, Receiver Operation, Receiver Sensitivity, Structures For InGaAs APDs System Performance Evaluation Criteria, Eye Diagram, and BER	06
5.	Transmission System and amplification : Concept of Digital Link, Point to Point Link, System Design Considerations, Link Power Budget, Rise Time Budget, Power Penalty. Principles of WDM, DWDM, Active & Passive Optical Components, Tunable sources and Filters, Principle of Optical Amplification, Erbium-Doped Fiber Amplifiers, Raman Amplifiers, Semiconductor Optical Amplifiers. SONET/SDH, Optical	08

Unit No.	Topics	Teaching Hours
	switching.	
6.	Advances in Optical Fiber Systems and Measurements : Refractive Index Measurements, Attenuation Measurement, Dispersion Measurement, OTDR Field Applications, Optical Performances Monitoring, optical fiber system performance measurements , introduction to next generation technology Case studies : field visit to telecom industries to observe real time practical problems , Light Fidelity (Li-Fi) technology	07
Total		45

List of References:

1. Gerd Keiser, “*Optical Fiber Communications*”, Mc Graw Hill, 5th Edition,2017.
2. G.Agrawal, “*Fiber-optic Communication Systems*”, John Wiley and sons,4th Edition,2010.
3. John M. Senior, “*Optical Fiber Communication*”, PHI,3rd Edition,2010.

Course Outcomes (COs) :

By learning this course students will be able to ...

1. Understand the basic concept of optical fiber communication, fiber modes, and structure configurations.
2. Evaluate the significance of the different kinds of losses, signal distortion in optical system performance.
3. Clarify the various optical source materials, LED and Laser structures, quantum efficiency.
4. Analyze the fiber optical receiver operation and configuration.
5. Study and measure the system performance of optical transmitters, receivers, and optical amplifiers.
6. Analyze optical fiber link with encapsulation of different system components.