

<b>FIBER OPTICS and NETWORKS</b>			
<b>B.E., VIII Semester, Electronics &amp; Communication Engineering</b>			
<b>[As per Choice Based Credit System (CBCS) Scheme]</b>			
<b>Course Code</b>	<b>17EC82</b>	<b>CIE Marks</b>	<b>40</b>
<b>Number of Lecture Hours/Week</b>	<b>4</b>	<b>SEE Marks</b>	<b>60</b>
<b>Total Number of Lecture Hours</b>	<b>50(10 Hours / Module)</b>	<b>Exam Hours</b>	<b>03</b>
<b>CREDITS – 04</b>			
<p><b>Course Objectives:</b> This course will enable students to:</p> <ul style="list-style-type: none"> <li>• Learn the basic principle of optical fiber communication with different modes of light propagation.</li> <li>• Understand the transmission characteristics and losses in optical fiber.</li> <li>• Study of optical components and its applications in optical communication networks.</li> <li>• Learn the network standards in optical fiber and understand the network architectures along with its functionalities.</li> </ul>			
<b>Module -1</b>			
<p><b>Optical fiber Communications:</b> Historical development, The general system, Advantages of optical fiber communication, Optical fiber waveguides: Ray theory transmission, Modes in planar guide, Phase and group velocity, Cylindrical fiber: Modes, Step index fibers, Graded index fibers, Single mode fibers, Cutoff wavelength, Mode field diameter, effective refractive index. Fiber Materials, Photonic crystal fibers. (Text 2) <b>L1, L2</b></p>			
<b>Module -2</b>			
<p><b>Transmission characteristics of optical fiber:</b> Attenuation, Material absorption losses, Linear scattering losses, Nonlinear scattering losses, Fiber bend loss, Dispersion, Chromatic dispersion, Intermodal dispersion: Multimode step index fiber.</p> <p><b>Optical Fiber Connectors:</b> Fiber alignment and joint loss, Fiber splices, Fiber connectors, Fiber couplers. (Text 2) <b>L1, L2</b></p>			
<b>Module -3</b>			
<p><b>Optical sources:</b> Energy Bands, Direct and Indirect Bandgaps, Light Emitting diodes: LED Structures, Light Source Materials, Quantum Efficiency and LED Power, Modulation. Laser Diodes: Modes and Threshold conditions, Rate equation, External Quantum Efficiency, Resonant frequencies, Laser Diode structures and Radiation Patterns: Single mode lasers.</p> <p><b>Photodetectors:</b> Physical principles of Photodiodes, Photodetector noise, Detector response time.</p> <p><b>Optical Receiver:</b> Optical Receiver Operation: Error sources, Front End Amplifiers, Receiver sensitivity, Quantum Limit. (Text 1) <b>L1, L2</b></p>			
<b>Module -4</b>			

**WDM Concepts and Components:** Overview of WDM: Operational Principles of WDM, WDM standards, Mach-Zehnder Interferometer Multiplexers, Isolators and Circulators, Fiber grating filters, Dielectric Thin-Film Filters, Diffraction Gratings, Active Optical Components, Tunable light sources,

**Optical amplifiers:** Basic application and Types, Semiconductor optical amplifiers, Erbium Doped Fiber Amplifiers, Raman Amplifiers, Wideband Optical Amplifiers. (Text 1) **L1, L2**

### **Module -5**

**Optical Networks:** Optical network evolution and concepts: Optical networking terminology, Optical network node and switching elements, Wavelength division multiplexed networks, Public telecommunication network overview. Optical network transmission modes, layers and protocols: Synchronous networks, Asynchronous transfer mode, OSI reference model, Optical transport network, Internet protocol, Wavelength routing networks: Routing and wavelength assignment, Optical switching networks: Optical circuit switched networks, packet switched networks, Multiprotocol Label Switching, Optical burst switching networks, Optical network deployment: Long-haul networks, Metropolitan area networks, Access networks, Local area networks. (Text 2) **L1, L2**

**Course Outcomes:** At the end of the course, students will be able to:

1. Classification and working of optical fiber with different modes of signal propagation.
2. Describe the transmission characteristics and losses in optical fiber communication.
3. Describe the construction and working principle of optical connectors, multiplexers and amplifiers.
4. Describe the constructional features and the characteristics of optical sources and detectors.
5. Illustrate the networking aspects of optical fiber and describe various standards associated with it.

#### **Text Books:**

1. Gerd Keiser , Optical Fiber Communication, 5<sup>th</sup> Edition, McGraw Hill Education(India) Private Limited, 2015. ISBN:1-25-900687-5.
2. John M Senior, Optical Fiber Communications, Principles and Practice, 3<sup>rd</sup> Edition, Pearson Education, 2010, ISBN:978-81-317-3266-3

#### **Reference Book:**

Joseph C Palais, Fiber Optic Communication , Pearson Education, 2005, ISBN:0130085103