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| **Course Title** | **Course Structure** | **Pre-Requisite** |
| **Fiber Optics and Optical Communication**  B.Tech. (EP), 6th Sem | |  |  |  | | --- | --- | --- | | **L** | **T** | **P** | | **3** | **0** | **2** | | Knowledge of the basic concepts of optics.  Knowledge of the partial differential equations, their solutions & special functions |

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| **Course Objectives:**  The major objective of the course is to provide the concepts in fiber optics with the understanding of various optical modes. The students are given a thorough knowledge about various signal degradation mechanism along with their overcome techniques. The course focuses on developing understanding to design an optical communication system including sources, detector and signal guiding mechanisms. |

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| **Course Outcomes (COs)**   1. To understand the light guidance in optical fibers and to examine the different kinds of losses and signal distortion along with their compensation techniques in optical fibers. 2. To analyse and explain the light guidance in optical waveguides through modal analysis. 3. To identify and examine the different kinds of losses and signal distortion along with their compensation techniques in optical fibers 4. To develop the knowledge of optical sources, their principle of operation and characteristics 5. To understand the operation of various optical detectors and design an optical communication link |

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| **S. No.** | **Content** | **Contact Hours** |
| 1. | Introduction and importance of Fiber Optics Technology. Ray analysis of optical fiber: Basic Characteristics of the optical fiber, Attenuation in optical fibers, Loss mechanisms : Absorptive Losses, Radiative Losses and Fresnel Reglection, Fabrication of optical fibers | **08** |
| 2. | Electromagnetic mode theory for optical propagation, Maxwell’s equations in inhomogeneous media, Modal analysis of planar step index waveguide, Physical Understanding of the modes, Power associated with the modes  Propagation characteristics and Modal analysis for the step index fiber, Scalar modes in the weakly guiding mechanism, Power associated with modes, Splice loss | **12** |
| 4. | Signal degradation in optical fiber due to dispersion , Pulse broadening in optical fibers, Bit rate length product , Pulse dispersion , Material dispersion, Waveguide dispersion and design considerations | **08** |
| 5. | Optical Sources: Communication Requirements, Absorption and emission of radiation, Energy Bands and carrier distribution in semiconductors, Optical Gain in semiconductors, Laser oscillation and threshold current,  Laser diode characteristics: Laser threshold, Output Spectrum, Radiation pattern, Modulation of semiconductor lasers  LED characteristics, Responsivity, Output spectrum, Radiation Pattern, Modulation | **08** |
| 6. | Detectors for optical fiber communication, Principle of optical detection, PIN photodetector, Responsivity and Quantum Efficiency, Avalanche Photodiode  Design of an optical communication link | **06** |
|  | **Total** | **42** |

**List of experiments**

1. To study PI and VI characteristics of LED Module.
2. To study the PI and VI characteristics of Laser diode module.
3. To study PI and VI characteristics of Photodetector module.
4. To study numerical aperture, mode field diameter and V value of Single mode fiber.
5. To determine numerical aperture, mode field diameter and V value of a multimode fiber.
6. To study the length dependence of attenuation on the given optical fiber at different Wavelengths.
7. (a) To determine the time delay between pulses in single mode fiber due to group velocity dispersion.

(b) Compare the experimental results with the theoretical prediction, calculated from refractive index spectrum of pure silica.

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| **S.No.** | **Name of Books/ Authors** | **Year of Publication/ Reprint** |
|  | Introduction to Fiber Optics by Ghatak and Thyagrajan | 2017/Cambridge University Press |
|  | Fibre Optic communication by Keiser (Fifth Edition) | 2017 / McGraw Hill. |
|  | Fundamentals Of Photonics by B.E.A. Saleh and M.C. Teich | 2018/ Wiley Series in Pure and Applied Optics |
|  | Optical Fiber Communications: Principles and Practice by John M. Senior | 2014/ Pearson |
|  | Optical fibres telecommunication by S.E. Miller & A.G. Chynoweth | 2010/ Academic Press |
|  | Fiber-Optic Communication Systems, 5th Edition by Govind P. Agrawal | 2021/ Wiley |
|  | Optoelectronics and Photonics by S.O. Kasap | 2010/Pearson |
|  | Fiber Optics Handbook for engineers and scientists by F.C. Allard | 2009/ McGraw Hill |

**Suggested Book**