**19EC3204 – FIBER OPTICAL COMMUNICATION**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course category:** | Program Elective | **Credits:** | 3 |
| **Course Type:** | Theory | **Lecture - Tutorial - Practical:** | 3 - 0 – 0 |
| **Prerequisite:** | Electro Magnetic Fields and waves, Antenna and Wave Propagation, Electronic Devices and Circuits. | **Sessional Evaluation :**  **External Evaluation:**  **Total Marks:** | 40  60  100 |

|  |  |  |
| --- | --- | --- |
| **Course**  **Objectives** | Students undergoing this course are expected tounderstand: | |
| 1. An overview of the Ray theory. 2. Optical materials, dispersion, diffraction, absorption, scattering, fiber losses, fiber modes and configurations, fiber types and rays and fiber materials. 3. L.E.D., Lasers and their excitations and noises of light sources and coupling to single mode fibers, splicing and connectors. 4. The operating principles of optical Detectors and Receivers. 5. The behavior of the optical amplifiers, semiconductor and doped optical amplifiers, and optical networks. 6. The knowledge of measurement of optical parameters and applications of optical fibers in different fields. | |
| **Course Outcomes** | Upon successful completion of the course , the students will be able to: | |
| CO1 | Acquire knowledge about optical materials, fiber characteristics, classification with different losses. |
| CO2 | Understand the fibre modes, configurations and fibre materials for proper optical propagation. |
| CO3 | Acquire knowledge of L.E.D., Laser excitations, fiber noises, coupling of fibers and its receivers. |
| CO4 | Analyse optical sources and detectors and receivers’ performance and calculation |
| CO5 | Understand the optical amplifiers and basic noise networks in optical fiber applications. |
| CO6 | Understand the measurements of optical parameters and applications of optical fibers in different fields. |
| **Course**  **Content**  **Course**  **Content** | **UNIT-I**  **INTRODUCTION TO OPTICAL FIBERS**: Introduction- Ray theory transmission-Total internal reflection-Acceptance angle –Numerical aperture – Skew rays – Electromagnetic mode theory of optical propagation –EM waves modes in planar Guide – phase and group velocity – cylindrical fibers – SM fibers.  **UNIT –II**  **TRANSMISSION CHARACTERISTICS OF OPTICAL FIBERS:** Attenuation – Material absorption losses in silica glass fibers – Linear and Nonlinear Scattering losses - Fiber Bend losses – Midband and Farband infrared Transmission – Intra and inter Modal Dispersion – Over all Fiber Dispersion – Polarization- nonlinear Phenomena. Optical fiber connectors, Fiber alignment and Joint Losses – Fiber Splices – Fiber connectors –Expanded Beam Connectors – Fiber Couplers.  **UNIT –III**  **FIBER OPTICAL SOURCES**: Light Emitting Diodes, LED structures, Surface and edge emitters, mono and hetero structures - internal - quantum efficiency, injection laser diode structures - comparison of LED and ILD  **UNIT –IV**  **FIBER OPTICAL DETECTORS AND RECEIVERS:**  **OPTICAL DETECTORS**: PIN Photo detectors, Avalanche photo diodes, construction, characteristics and properties, Comparison of performance, Photo detector noise -Noise sources, Signal to Noise ratio, Detector response time.  **OPTICAL RECEIVERS**: Fundamental receiver operation, Pre amplifiers, Error sources – Receiver Configuration-Probability of Error – Quantum limit.  **UNIT- V**  **FIBER OPTICAL AMPLIFIERS AND NETWORKS**: Semiconductor Optical amplifiers – EDFA- Raman amplifier.  **WDM SYSTEM**: Principles of WDM networks. Nonlinear effects in fiber optic links. Concept of self-phase modulation, group velocity dispersion and solution based communication.  **UNIT- VI**  **FIBER OPTICAL MEASUREMENTS**: Fiber Attenuation measurements- Dispersion measurements –Fiber Refractive index profile measurements – Fiber cut- off Wavelength Measurements –Fiber Numerical Aperture Measurements – Fiber diameter measurements.  **OPTICAL FIBER APPLICATIONS**: Telephony Telemetry- video distribution and military applications. | |
| **Text Books and Reference Books** | **TEXT BOOKS:**   1. “Optical Communications”, C. Gerd Keiser 3rd Edition, Mc Graw-Hill-2000. 2. “Optical Fiber Communication”, John M Senior, Pearson publications.   **REFERENCE BOOKS:**   1. Electronic Communications Systems-Williams Schweber, Prentice Hall, 1999. 2. Optical Fiber Communication Systems- C.P. Saud Bance, John Wiley 1980. 3. Modern Electronic Communication-G.M. Miller 6th edition Prentice Hall 1999. | |
| **E-Resources** | 1. <http://nptel.ac.in/courses/117103063/1> 2. <https://www.youtube.com/user/nptelhrd> | |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Contribution of Course Outcomes towards achievement of Program Outcomes** | | | | | | | | | | | | | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | 3 | 2 | 2 | 1 | - | - | - | - | - | - | 2 | 3 | 3 |
| CO2 | 3 | 3 | 2 | 2 | 1 | 1 | - | - | - | 1 | - | 2 | 3 | 2 |
| CO3 | 3 | 3 | 3 | 1 | 1 | - | 1 | - | - | 1 | - | 2 | 2 | 3 |
| CO4 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | - | - | - | - | 2 | 2 | 3 |
| CO5 | 3 | 3 | 2 | 2 | 1 | 1 | - | - | - | 1 | - | 2 | 3 | 2 |
| CO6 | 3 | 3 | 2 | 2 | 1 | - | - | - | - | 1 | - | 2 | 3 | 2 |