**20EC3203-FIBER OPTIC COMMUNICATIONS**

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| **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:** | 4060100 |
| **Course****Objectives** | Students undergoing this course are expected to understand the: |
| 1. 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. LED, LASERs and their excitations and noises of light sources and coupling to single mode fibers, splicing and connectors.
4. Operating principles of optical detectors and receivers.
5. Behavior of the optical amplifiers, semiconductor and doped optical amplifiers, and optical networks.
6. Knowledge of measurement of attenuation and dispersion.
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| **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 transmission characteristics and fiber materials for proper optical propagation. |
| CO3 |  Acquire knowledge of LED, LASER excitations, fiber noises, coupling of fibers and its receivers. |
| CO4 | Analyze optical sources,detectors and receivers performance and calculation. |
| CO5 | Understand the optical amplifiers and basic noise networks in optical fiber applications. |
| CO6 | Understand the measurements of attenuation and dispersion. |
| **Course****Content****Course****Content** | **UNIT-I****INTRODUCTION TO OPTICAL FIBERS**: Introduction, Basic optical laws and definitions: Ray theory transmission, Total internal reflection, Acceptance angle, Numerical aperture, Skew Rays, optical fiber modes and configurations, mode theory for circular waveguides, light propagation in single mode and multi-mode fibers, fiber materials. **UNIT –II**TRANSMISSION CHARACTERISTICS OF OPTICAL FIBER: Attenuation, Absorption losses, Scattering losses, Bending Losses, Core and Cladding losses, Signal Distortion in Optical Wave guides: Information Capacity determination, Group Delay, Material Dispersion, Wave guide Dispersion, Signal distortion in SM fibers, Polarization Mode dispersion, Intermodal dispersion. Pulse broadening in graded- index waveguides, Mode coupling, Design optimization of single mode fibers, Refractive Index profile and cut-off wavelength of fibers.**UNIT –III****FIBER OPTICAL SOURCES**: Light Emitting Diode (LED): LED structures, Light source materials, Surface and Edge Emitting LEDs, Quantum efficiency and LED power.**LASER Diodes:** Injection LASER diode structures, Quantum efficiency and comparison of LED and LASER diodes. fiber - to- fiber joints, fiber splicing, Optical Connectors.**UNIT –IV****FIBER OPTICAL DETECTORS AND RECEIVERS:** **OPTICAL DETECTORS**: PIN Photo detectors, Avalanche Photo diodes, construction, characteristics and properties, comparison of photo detectors, photo detector noise,noise sources, Signal to Noise Ratio, detector response time.**OPTICAL RECEIVERS**: Fundamental receiver operation, digital receiver performance.**UNIT- V****FIBER OPTICAL AMPLIFIERS AND NETWORKS**: Semiconductor Optical amplifiers – EDFA- Raman amplifier. **WDM SYSTEM**: Operational principles of WDM, Types of WDM Systems, Passive components.**UNIT- VI****FIBER OPTICAL MEASUREMENTS**: Fiber attenuation measurements: The cutback techniques, Insertion loss method. Dispersion measurements: Intermodal dispersion, time- domain intermodal dispersion measurements, frequency - domain intermodal dispersion measurements, chromatic dispersion, polarization mode dispersion, Eye Patterns. |
| **Text Books and Reference Books** | **TEXT BOOKS:**1. “Optical fiber Communications”, by Gerd Keiser, McGraw-Hill, 5th Edition,2017.
2. “Optical Fiber Communication”, by John M Senior, Pearson publications, 3rd edition, 2014.
3. “Optical Communication Systems”, by Satinder Bal Gupta & Ashish Goel, University Science Press, 2nd edition, 2011.

**REFERENCE BOOKS:**1. “Electronic Communications Systems”, by Williams Schweber, Prentice Hall, 4th edition, 2002.
2. “Optical Fiber Communication Systems” , by C.P. Saud Bance, John Wiley.
3. “Modern Electronic Communication” by G.M. Miller, Prentice Hall,9th edition 2007.
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| **E-Resources** | 1. <http://nptel.ac.in/courses/117103063/1>
2. <https://www.youtube.com/user/nptelhrd>
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| **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 |