

## IV B.Tech – I Semester

### (20EC7320) FIBER OPTIC COMMUNICATIONS (Program Elective-III)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	0	0	3

**Pre-Requisites:** Applied Physics

#### **Course Objectives:**

- To realize the significance of optical fiber communications
- To understand the construction and characteristics of optical fiber cable
- To Analyze the operation of LEDs, laser diodes, and PIN photo detectors (spectral properties, bandwidth, and circuits) and apply in optical systems
- To identify and understand the operation of various optical detectors
- To under the design of optical systems and WDM

#### **UNIT I: Overview of Fiber Optic Communication**

Historical development, The general system, advantages of optical fiber communications. Optical fiber wave guides- Introduction, Ray theory transmission, Total Internal Reflection, Acceptance angle, Numerical Aperture, Skew rays, Cylindrical fibers- Modes, V-number, Mode coupling, Step Index fibers, Graded Index fibers, Single mode fibers- Cut off wavelength, Mode Field Diameter, Effective Refractive Index, Related problems.

#### **UNIT II: Signal Distortion in Optical Fibers**

Fiber materials:- Glass, Halide, Active glass, Chalgenide glass, Plastic optical fibers. Signal distortion in optical fibers-Attenuation, Absorption, Scattering and Bending losses, Core and Cladding losses, Information capacity determination, Group delay, Types of Dispersion:- Material dispersion, Wave-guide dispersion, Polarization-Mode dispersion, Intermodal dispersion, Pulse broadening in Graded index fiber, Related problems.

Optical fiber Connectors-Connector types, Single mode fiber connectors, Connector return loss, Fiber Splicing-Splicing techniques, Splicing single mode fibers, Fiber alignment and joint loss- Multimode fiber joints, single mode fiber joint.

#### **UNIT III: Optical sources**

LEDs, Structures, Materials, Quantum efficiency, Power, Modulation, Power bandwidth product. Injection Laser Diodes- Modes, Threshold conditions, External quantum efficiency, Laser diode rate equations, Resonant frequencies, Reliability of LED&ILD, Optical detectors- Physical principles of PIN and APD, Detector response time, Temperature effect on Avalanche gain, Comparison of Photo detectors, Related problems.

#### UNIT IV: Source to Fiber power launching

Output patterns, Power coupling, Power launching, Equilibrium Numerical Aperture, Laser diode to fiber coupling, Optical receiver operation- Fundamental receiver operation, Digital signal transmission, error sources, Receiver configuration, Digital receiver performance, Probability of Error, Quantum limit, Analog receivers.

#### UNIT V: Optical system design

Point-to- point links- Component choice and considerations, Link power budget, Rise time budget with examples, Line coding in Optical links, WDM, Necessity, Principles, Measurement of Attenuation and Dispersion, Eye pattern.

#### Course Outcomes:

After successful completion of the course, the students can be able to

S. No	Course Outcome	BTL
1	Choose necessary components required in modern optical communications systems	L2
2	Design and build optical fiber experiments in the laboratory, and learn how to calculate electromagnetic modes in waveguides, the amount of light lost going through an optical system, dispersion of optical fibers	L3
3	Estimate the losses due to attenuation, absorption, scattering and bending	L3
4	Use different types of photo detectors and optical test equipment to analyze optical fiber and light wave systems	L2
5	Choose the optical cables for better communication with minimum losses Design, build, and demonstrate optical fiber experiments in the laboratory	L2

#### Correlation of COs with POs & PSOs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	-	-	-	-	-	-	-	-	-	2	-
CO2	2	2	2	-	-	-	-	-	-	-	-	-	2	-
CO3	2	2	2	-	-	-	-	-	-	-	-	-	2	-
CO4	2	2	2	-	-	-	-	-	-	-	-	-	2	-
CO5	2	2	2	-	-	-	-	-	-	-	-	-	2	-

#### Text Books:

1. Optical Fiber Communications – Gerd Keiser, Mc Graw-Hill International edition, 3rd Edition, 2000.
2. Optical Fiber Communications – John M. Senior, PHI, 2nd Edition, 2002.

#### Reference Books:

1. Fiber Optic Communications – D.K. Mynbaev , S.C. Gupta and Lowell L. Scheiner, Pearson Education,2005.

2. Text Book on Optical Fiber Communication and its Applications – S.C.Gupta, PHI, 2005.
3. Fiber Optic Communication Systems – Govind P. Agarwal , John Wiley, 3rd Edition, 2004.
4. Fiber Optic Communications – Joseph C. Palais, 4th Edition, Pearson Education, 2004.