P42

APR - 17/BE/Insem - 47
B.E. (E & TC) (Semester - II)
BROADBAND COMMUNICATION SYSTEMS
(2012 Pattern)

Time : 1 Hour]   *[Maximum Marks : 30*
Instructions to the candidates:

1) *Solve Q. 1 or Q.2, Q.3 or Q.4, and Q.5 or Q.6*

2) *Neat diagrams must be drawn wherever necessary.*

3) *Figures to the right indicate full marks.*

4) *Assume suitable data if necessary.*

Q1) a) A step index fiber in air has a numerical aperture of 0.16, a core refractive index of 1.45 and a core diameter of $60\,\mu$m. Determine normalized frequency for the fiber when light at a wavelength of $0.9\,\mu$m. is transmitted. further. estimate the number of guided modes propagating in the fiber **[6]**

b) Explain three windows of transmission for optical fiber based on fiber attenuation characteristics. **[4]**

OR

Q2) a) Compare and contrast PIN photo diode & APD as optical detector in fiber communication. **[6]**

b) Enlist & explain any four losses in optical fiber communication system. **[4]**

Q3) a) An optical fiber system is to be designed to operate over an 8 km length without repeaters. The rise times of the chosen components are. **[6]**

Source: 8 nsec, fiber (inter modal):5ns/km.

Fiber (intra modal): 1nsec/km, detector: 6 nsec.

Estimate the maximum bit rate that may be achieved on the link when using an NRZ format and RZ format.

b) Write a short note on long haul system. **[4]**

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OR

Q4) a) Components are chosen for a digital optical fiber link of overall length 7km, 20 Mbps data rate and Rz code. An LED emitting at 0.85 μm is capable of launching an average of 100 μw of optical power. (Including connector loss). A graded index fiber of 50 μm core diameter is chosen. The fiber has attenuation of 2.6 dB/km and requires splicing every kilometer with loss of 0.5dB/splice. There is also a connector loss at receiver of 1.5dB. Receiver requires mean incident optical power of -41dBm for necessary BER of 10^{-10}, safety margin of 6dB will be required. Write down the optical power budget for the system and hence determine its viability. **[6]**

b) Define the following terms with respect to photo detector. **[4]**

   i) Responsivity

   ii) Quantum Efficiency

Q5) a) A 2×2 biconical tapered fiber coupler has an i/p optical power Po=300 μw. The o/p powers at the three other ports are P_1=150 μw, P_2=65 μw & P_3=8.3nw. **[6]**

   Calculate coupling ratio (splitting ratio), excess loss insertion loss and cross talk for the coupler.

b) Explain working principle of FBG **[4]**

OR

Q6) a) Explain working principle of EDFA **[6]**

b) Explain working of optical circulator based on FBG principle **[4]**

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