B.E. (Electronics Engineering / Elect. & Telecommunication / Elect. & Communication Engineering) Seventh Semester (C.B.S.)

Optical Communication

P. Pages : 2 **NRJ/KW/17/4584/4592**

Time : Three Hours * 0 4 4 5 * Max. Marks : 80

Notes :
1. All questions carry marks as indicated.
2. Solve Question 1 OR Questions No. 2.
3. Solve Question 3 OR Questions No. 4.
4. Solve Question 5 OR Questions No. 6.
5. Solve Question 7 OR Questions No. 8.
6. Solve Question 9 OR Questions No. 10.
7. Solve Question 11 OR Questions No. 12.
8. Due credit will be given to neatness and adequate dimensions.
9. Assume suitable data whenever necessary.
10. Illustrate your answers whenever necessary with the help of neat sketches.
11. Use of non programmable calculator is permitted.

1. a) Draw the block diagram of optical communication system. Explain the function of each block State the advantages and disadvantages of optical communication as compared to microwave link. **7**

b) Calculate the numerical aperature of step index fiber having $n_1 = 1.48$ and $n_2 = 1.46$ what is the maximum entrance angle for this fiber if the outer medium is air with n=1. **6**

OR

2. a) For a step index fiber prove that $NA = n_1(2\Delta)^{1/2}$ **7**

b) Using ray theory discuss transmission of light through graded index fiber. **6**

3. a) Prove that $Mg = \frac{V^2}{4}$ for graded index fiber having parabolic profile where Mg = Mode. volume for graded index fiber and N = Normalized frequency. **7**

b) Explain Vapor phase axial deposition method for fabrication of optical fibers. **6**

OR

4. a) Draw the schematic diagram of fiber drawing apparatus and explain its working. **7**

b) Explain double crucible method of fiber fabrication with neat diagram. **6**

5. a) Discuss the following losses in optical fibers. **7**
i) Scattering loss. ii) Bending loss.

b) Describe various mechanism of dispersion in optical fibers. **6**

OR

6.	a)	What are direct and indirect band gap materials. Explain why direct band gap materials are suitable for manufacturing of optical sources.	**7**
	b)	A lens coupled surface emitting LED launches 600 microwatts of optical power into step index fiber. Determine overall power conversion efficiency if it is operating with current of 100 mA and forward voltage of 1.9 V, If NA of fiber is 0.5. Estimate coupling efficiency and optical loss in dB.	**6**
7.	a)	Discuss the basis requirement of photo detector. Define quantum efficiency and responsivity of photo detector and derive an expression for responsivity of an intrinsic photodetector in terms of quantum efficiency.	**7**
	b)	A Silicon avalanche photodiode has quantum efficiency of 55% at a wavelength of 800 nm. Suppose $0.5\,\mu w$ optical power produced a multiplied photo current of $9\,\mu A$. Find multiplication factor M.	**7**

OR

8.	a)	A Ge photodiode incorporated into optical fiber receiver working at the wavelength of $1.55\ \mu m$ has a dark current of 500 nA at the operating temperature. The incident optical power at wavelength is $1\,\mu w$ and responsivity of device is 0.6 A/w. Shot noise dominates in the receiver. The post detector bandwidth is 100 mHz. Determine the SNR in dB.	**7**
	b)	Draw the schematic diagram of typical optical receiver and explain its working.	**7**
9.	a)	Explain the block diagram of basic elements of analog link and major noise distributions associated with it.	**7**
	b)	What are the different system considerations of designing digital transmission system. Explain rise time budget and link power budget.	**6**

OR

10.	a)	Explain concept of Carrier to Noise Ratio (CNR) in analog link.	**7**
	b)	A 5 km fiber link is to be installed for following data. i) Fiber attenuation of 1dB/km. ii) 11 connectors with connection loss of 1.3 dB/ connector. iii) Receiver sensitivity of -50 dB m. iv) System margin of 6dB. Calculate source power if splices are negligible.	**6**
11.	a)	Describe the method of measuring losses in optical fiber using Optical Time Domain Reflectometer (OTDR) Explain how this method has an improvement over cut back method.	**7**
	b)	Explain Erbium Doped Fiber Amplifier (EDFA). State its advantages and disadvantages.	**7**

OR

12.	a)	Explain WDM (wavelength division multiplexing) with block diagram.	**7**
	b)	Explain frequency domain method for measurement of dispersion.	**7**

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