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

Optical Communication

P. Pages : 2 **KNT/KW/16/7445/7453**

Time : Three Hours * 0 8 2 2 * 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. Assume suitable data whenever necessary.
9. Illustrate your answers whenever necessary with the help of neat sketches.

1. a) With the help of ray diagram show how optical fibers can guide light waves. **7**

b) A step index fiber has $n_1 = 1.44$ and $n_2 = 1.42$ respectively. Calculate the acceptance angle in air for skew rays which changes direction by 150^o at each reflection. Also calculate the critical angle. **6**

OR

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

b) Explain what is meant by a graded index optical fiber, giving an expression for the possible refractive index profile. **6**

3. a) Describe with neat sketch the modified chemical vapour deposition process (MCVD) of optical fiber fabrication. **7**

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

OR

4. a) Describe various mechanisms of dispersion in optical fibers. Explain the effect of dispersion on the bandwidth of optical communication channel. **7**

b) When the mean optical power launched into an 8 km length of fiber is 120 μw, the mean optical power at the fiber output is 3 μw. Determine : **6**
   i) The overall signal attenuation or loss in decibels through the fiber assuming there are no connectors or splices.
   ii) The signal attenuation per kilometer for the fiber.
   iii) The overall signal attenuation for a 10 km optical link using the same fiber with splices at 1 km intervals, each giving an attenuation of 1 dB.

5. a) What is splicing? Explain the basic splicing techniques used. **7**

b) Briefly describe the different types of optical connectors used in optical communication. **7**

OR

6. a) Give the constructional details of surface emitter (Burrus type) LED and state its advantages. **7**

b) A lens coupled surface emitting LED launches 500 μw of optical power into a step index fiber. Determine the overall power conversion efficiency if it is operating with a drive current of 100 mA, a forward voltage of 1.5 V and NA of fiber is 1.2. Estimate coupling efficiency and optical loss in dB. **7**

7. a) Discuss the basic requirements of photo-detector. Define quantum efficiency and responsivity of photo-detectors and derive an expression for the responsivity of an intrinsic photo-detector in terms of quantum efficiency. **7**

b) A PIN photodiode has a quantum efficiency of 33% at 0.8 μm wavelength. **6**
Calculate :
i) Its maximum possible band gap energy.
ii) Mean output photo current when the received optical power is 0.1 μw.
($h = 6.626 \times 10^{-34}$ Js)

OR

8. a) Draw the block diagram of Typical optical Receiver and explain its working in detail. **6**

b) Explain the working principle of Avalanche photo diode & draw its equivalent circuit. **7**

9. a) Explain the block diagram of basic element of analog link. **7**

b) A 5 km fiber link is to be installed for following data. **6**
i) Fiber attenuation of 1 dB/km.
ii) 11 connectors with connection loss of 1.3 dB/connector.
iii) Receiver sensitivity of 50 dBm.
iv) System margin of 6 dB. Calculate the source power (Assume no splices).

OR

10. a) Explain in detail the concept of carrier to noise ratio (CNR) in analog link. **6**

b) What are the different system considerations for designing a digital transmission system. (digital link). **7**

11. a) With the help of neat block diagram, explain the working of WDM system. **7**

b) Write a note on working principle of semiconductor optical amplifiers. **7**

OR

12. a) Explain the Erbium – doped optical amplifiers. State the advantages and disadvantages. **7**

b) Explain OTDR method of fiber attenuation measurement. Compare it with cut back method of attenuation. **7**

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