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

Optical Communication

P. Pages : 2 **TKN/KS/16/7532/7540**

Time : Three Hours * 0 9 5 7 * 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 a block diagram of optical fiber transmission link and explain the function of each block. **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 150º at each reflection. Also calculate the critical angle. **6**

OR

2. a) Define normalised frequency. Prove that mode volume of GI fiber Is $Mg = \frac{V^2}{4}$ where Mg is mode volume for GI fiber. V is normalised frequency. **7**

b) With the help of ray diagram show haw optical fibers can guide light waves. Also explain modes and numerical aperature. **6**

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

b) What are the different types of attenuation losses in optical fibers. Discuss absorption losses in optical fibers. **6**

OR

4. a) Discuss bending losses in optical fiber with the help of neat sketches. Explain the cause of this losses. **7**

b) A continuous 12km long optical fiber link has a loss of 1.5 dB/km. **6**
   i) What is the minimum optical power level that must be launched into the fiber to maintain an optical power level of 0.3μW at the receiving end.
   ii) What is the required input power in the fiber if it has a loss of 2.5 dB/km.

5. a) What is splicing ? Explain with the aid of suitable diagrams the basic splicing techniques used in details. **6**

b) Discuss direct and indirect bandgap semiconductor materials. Explain why direct bandgap materials are suitable for manufacturing of optical sources. **4**

c) Differentiate between 3dB optical and 3dB electrical BW with regards to LED. **4**

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 600μw of optical power in SI fiber. Determine the overall power conversion efficiency if it is operating with a drive current of 100mA and a forward voltage of 1.9V. If the NA of fiber is 0.5, estimate the coupling efficiency and optical loss in dB. **7**

7. a) Explain the working principle of Avalanche Photo Diode (APD) with neat diagram. **7**

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

OR

8. 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) Draw the schematic of typical optical receiver and explain its working in details. **6**

9. a) What are the system considerations for a digital link ? Explain link power budget and rise time budget. **7**

b) A 5 km fiber link is to be installed for following data. **6**
i) Fiber attenuation of 1dB/km
ii) 11 connectors with connection loss of 1.3dB/connector
iii) Receiver sensitivity of -50 dBm
iv) System margin of 6dB. 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) Explain multichannel transmission techniques in analog link. **7**

11. a) Explain the basic operational principle of WDM. Explain its key features. **7**

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

OR

12. a) Explain the basic architecture of EDFA. **6**

b) Explain OTDR method of fiber attenuation measurement. Compare it with cut back method of attenuation. **8**

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