

**ET - Opto Electronics Devices and Communication**

P. Pages : 2

Time : Three Hours



**GUG/S/18/6581**

Max. Marks : 80

- Notes :
1. All questions carry marks as indicated.
  2. Due credit will be given to neatness and adequate dimensions.
  3. Assume suitable data wherever necessary.
  4. Illustrate your answers wherever necessary with the help of neat sketches.

1. a) Define the following term. 4  
i) Critical angle. ii) Numerical Aperture.  
b) Explain the optical communication system with block diagram. 6  
c) An optical fiber in air has an NA of 0.4. Compare the acceptance angle for meridional rays with that for skew rays which change direction by  $100^\circ$  at each reflection. 6

**OR**

2. a) Write short note on mode theory for circular waveguide. Write the wave equation for step index fiber. 8  
b) Consider a multimode fiber that has a core RI of 1.48 and core-cladding index difference 2.0. 8  
Find  
i) NA ii) Acceptance angle  
iii) Critical angle  
3. a) Explain material dispersion? Derive the expression for material dispersion for optical fibre. 8  
b) Write short note on. 8  
i) Raman scattering. ii) Brillouin scattering.

**OR**

4. a) Explain with neat diagram Vapor Axial deposition process for fabrication of optical fiber. 8  
b) What is the effect of mode coupling on pulse distortion in a fiber. 8  
5. a) Explain the erbium doped fiber amplifier with the help of simplified energy level diagram. 8  
b) Write short note on. 8  
i) Quantum-well LASER. ii) Quantum-dot LASER.

**OR**

6. a) Compare the ratio of the threshold current densities at 20°C and 80°C for an Al Ga As injection LASER with  $T_0 = 160\text{K}$  and the similar ratio for an InGaAsP device with  $T_0 = 55\text{K}$ . **8**
- b) Explain Raman Amplifier. Plot the Raman gain characteristic as a function of fiber length for standard single mode fiber. **8**
7. a) Describe factors which limit the speed of response of a photodiode. **8**
- b) What is photo detector? Explain the working of p-i-n photo detector with simple level diagram. **8**

**OR**

8. a) Explain the working principle of avalanche photodiode. Draw its equivalent circuit. **8**
- b) A digital fiber optic link operating at 850nm requires a maximum BER of  $10^{-9}$ . **8**
- i) Find out the energy required for conduction of photo detector.
- ii) Find out the minimum incident optical power  $P_i$  that must fall on the photodetector to achieve a  $10^{-9}$  BER at a data rate of 10Mb/s for a simple binary-level signaling scheme. Assume detector quantum efficiency  $\eta = 1$ .
9. a) Draw and explain eye pattern in optical communication. **8**
- b) Explain frequency chirping? Discuss its effect on single mode fiber link. **8**

**OR**

10. Write short note on. **16**
- i) OTDR ii) WDM
- iii) Star coupler iv) Block codes

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