USN | | | | | | | | | | |

10EC/TE72

Seventh Semester B.E. Degree Examination, June/July 2016
Optical Fiber Communication

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Discuss the advantages of optical fiber communication. **(06 Marks)**

b. With the help of neat diagrams discuss the structure of single mode and multi mode step index fibers with appropriate mathematical equations. **(06 Marks)**

c. Estimate the maximum core diameter for an optical fiber with refractive index difference of 1.6% and a core refractive index of 1.48, in order that it may be suitable for single mode operation for an operating wavelength of 0.9 μm. Further estimate the maximum core diameter for a single mode operation when the relative refractive index difference is reduced by a factor of 10. Assume V number as 2.405. **(08 Marks)**

2 a. Discuss different types of non linear scattering losses. **(06 Marks)**

b. Silica has an estimated fictive temperature of 1400 K with an isothermal compressibility of 7×10^{-11} m^2N^{-1}. The refractive index and photoelastic co-efficient for silica are 1.46 and 0.286 respectively. Determine the theoretical attenuation in decibels per kilometer due to fundamental Rayleigh scattering in silica at optical wavelength of 0.63 μm. Boltzmann's constant is 1.381×10^{-23} JK^{-1}. **(08 Marks)**

c. A step index multimode fiber with a core refractive index of 1.500, a relative refractive index difference of 3% and an operating wavelength of 0.82 μm. Estimate the critical radius of curvature at which large bending losses occurs. **(06 Marks)**

3 a. Explain with the help of neat diagram, distributed-feedback (DFB) laser diode. **(06 Marks)**

b. A double-hetrojunction In GaAsP LED emitting at a peak wavelength of 1310 nm has radiative recombination times of 30 and 100 ns, respectively. The drive current is 40 mA. Find the following:
i) The bulk recombination life time.
ii) The internal quantum efficiency.
iii) Internal power level (assume electron charge as 1.602×10^{-19} C) **(07 Marks)**

c. Discuss the operation of pin photodetector with appropriate diagrams. **(07 Marks)**

4 a. With appropriate mathematical equations explain single-mode fiber joints. **(06 Marks)**

b. Explain fusion splicing of optical fibers with appropriate diagrams. **(06 Marks)**

c. Briefly describe the principal of operation of the following:
i) Expanded beam connector.
ii) Star couplers. **(08 Marks)**

PART – B

5 a. With a schematic diagram, explain the working of an optical receiver. **(06 Marks)**

b. Explain the term receiver sensitivity. Derive an equation for receiver sensitivity in terms of photo detector noise. **(08 Marks)**

c. Discuss coherent detection with relevant block diagram. **(06 Marks)**

6 a. Discuss subcarrier multiplexing. **(06 Marks)**

b. Explain link power budget with a relevant diagram. **(06 Marks)**

c. Write a short note on:

i) Chirping.

ii) Extinction ratio penalty. **(08 Marks)**

7 a. Explain the principal of operation of WDM with relevant block diagram. **(07 Marks)**

b. Discuss the design and operation of a polarization independent isolator made of three miniature optical components. **(06 Marks)**

c. Explain with help of relevant diagrams various application of fiber Bragg gratings. **(07 Marks)**

8 a. With the help of energy level diagrams, explain the working of Erbium-Doped Fiber Amplifiers (EDFA). **(10 Marks)**

b. Write short notes on :

i) SONET / SDH frame formats.

ii) High-speed lightwave links. **(10 Marks)**

* * * * *