

| | | | | | | | | | |
|--|--|--|--|--|--|--|--|--|--|
| | | | | | | | | | |
|--|--|--|--|--|--|--|--|--|--|

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 $7 \times 10^{-11} \text{ m}^2 \text{N}^{-1}$. 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 $1.381 \times 10^{-23} \text{ JK}^{-1}$. (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 $1.602 \times 10^{-19} \text{ C}$) (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)
