



10EC/TE72

Seventh Semester B.E. Degree Examination, Dec.2019/Jan.2020
Optical Fiber Communication

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, selecting atleast TWO questions from each part.

PART - A

- 1 a. Explain briefly the following :
 - i) V number or normalized frequency of fiber.
 - ii) Mode – field diameter (MFD) of a single mode fiber. (06 Marks)
- b. Explain with a neat diagram, the photonic crystal fibers in optical fiber communication. (08 Marks)
- c. An optical fiber is air has NA of 0.4. Compare the acceptance angle for meridional rays with that for skew rays which change direction by 100° at each reflection. (06 Marks)
- 2 a. Explain the three different mechanisms that cause absorption of optical energy in optical fibers. (08 Marks)
- b. What are the types of linear scattering losses and explain them? (06 Marks)
- c. A 6km optical fiber consists of multimode step – index fiber, with a core refractive index of 1.5 and a relative index difference of 1%, estimate
 - i) Delay difference between slowest and fastest modes at the fiber output.
 - ii) rms pulse broadening due to inter – modal dispersion on the link.
 - iii) Maximum bit rate that may be obtained without substantial errors on the line assuming only inter – modal dispersion. (06 Marks)
- 3 a. With a neat diagram, explain the working of an edge emitting LED. Also mention its special features and usage. (08 Marks)
- b. Give comparison between Laser diode and light emitting diode, considering the various parameters. (06 Marks)
- c. A double – hetero junction InGaAsP LED emitting at a peak wavelength of 1310 nm has radiative and nonradiative recombination times of 25 and 90ns respectively. The drive current is 35mA.
 - i) Find the internal quantum efficiency and the internal power.
 - ii) If the refractive index of the light source material is $n = 3.5$. Find the power emitted from the device. (06 Marks)
- 4 a. Briefly describe the principle of the operation of the following :
 - i) Expanded beam connectors
 - ii) Fiber fused biconical taper coupler. (06 Marks)
- b. Define Fiber Splicing. Explain different types of splicing with sketches. (08 Marks)
- c. An LED has a circular emitting area of radius $35 \mu\text{m}$ and a Lambertian pattern with 150 W/cm^2 steradian of axial brightness for a given drive currents out of two step index fibers used, one has core radius $25 \mu\text{m}$ and $\text{NA} = 0.20$ and the other has core radius $50 \mu\text{m}$ and $\text{NA} = 0.20$. Calculate the power coupled to each fiber from the LED and compare. (06 Marks)

PART - B

- 5 a. Explain the receiver sensitivity of an optical receiver. Derive an expression for receiver sensitivity. (06 Marks)
- b. Explain the general configuration of eye diagram showing the definitions of fundamental measurement parameters. And also explain noise margin and timing jitter parameters. (09 Marks)
- c. Explain the operation of Burst mode receiver with receiver data pattern and signal level variation in pulses. (05 Marks)
- 6 a. Explain the optical power loss model with a neat diagram. (08 Marks)
- b. What is RF – over – fiber technique? Explain. (06 Marks)
- c. What is Frequency Chirping? Bring out its application in a typical optical communication system. (06 Marks)
- 7 a. Explain Operational principle and implementation of WDM with various features. (08 Marks)
- b. Explain the design and operation of polarization independent isolator. How it is different from polarization dependent isolator? (06 Marks)
- c. Explain the operation of optical Add/Drop multiplexer with a relevant diagram. (06 Marks)
- 8 a. Explain in detail the amplification mechanism with energy level diagram in an EDFA. (05 Marks)
- b. Describe i) SONET / SDH rings.
ii) SONET / SDH networks. (15 Marks)

24 JAN 2020