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 meridonal rays with
        that for skew rays which change direction by 100^0 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 – model 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 μm and a Lambersian 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 25μm and NA = 0.20 and the other has core radius 50μm
        and 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 fitter 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)**

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