6E 6058

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B.Tech. VI Semester (Main&Back) Examination,April.2019
Electronics & Communication Engg.
6EC6.3A Optical Fiber Communication

Time : 3 Hours

Maximum Marks : 80

Min. Passing Marks : 26

Instructions to Candidates:

Attempt any Five questions, selecting One question from each unit. All Questions carry equal marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly). Units of quantities used/calculated must be stated clearly.

Unit - I

1. a) Explain what you mean by a step index and graded index optical fiber. Giving an expression for the possible refractive index profile. Why a graded index fiber with a parabolic index profile is preferred? **(2+2+4)**

   b) A multimode step index fiber with a core diameter of 80 μm and a relative index difference of 1.5% is operating at a wavelength of 0.85 μm. If the core refractive index is 1.48, estimate:

   i) The normalized frequency for fiber.

   ii) The number of guided modes. **(4+4)**

(OR)

1. a) What is Dispersion? Explain and compare the dispersion shifted cable and dispersion flattened cable with neat diagram. **(2+4+2)**

   b) What are the materials require for manufacturing the optical fiber? Describe the modified chemical vapor phase deposition (MCVD) method for preparation of optical fiber. **(3+5)**

Unit - II

2. a) The radiative and non radiative recombination lifetimes of the minority carriers in the active region of a double hetro junctions LED are 60 ns and 100 ns respectively. Determine the total carrier recombination lifetime and the power internally generated within the device when the peak emission wavelength is 0.87 μm at a drive current of 40mA. **(4+4)**

   b) Explain direct bandgap and indirect bandgap semiconductor materials. Which type of material is use for optical fiber? Also explain their applications in optoelectronics. **(4+2+2)**

(OR)

2. a) What is the importance of LASER in optical communication? Drive the rate equation for laser diode. (4+4)

b) Describe the common LED structure for optical fiber communication; also give their merits and demerits. (4+2+2)

Unit - III

3. a) Explain the following terms of photo diode
   i) Quantum efficiency
   ii) Responsivity (4+4)

b) A 60/120 μm graded-index fiber with a numerical aperture of 0.25 and a profile parameter of 1.9 is jointed with a 50/120 μm graded-index fiber with a numerical aperture of 0.20 and a profile parameter of 2.1. If the fiber axes are perfectly aligned and there is no air gap, calculate the insertion loss at the joint in the forward and backward directions. (4+4)

(OR)

3. a) A four port multimode fiber FBT coupler has 60 μW optical power launched into port 1. The measured output power at port 2, 3 and 4 are 0.004, 26.0 and 27.5 μW respectively. Determine the excess loss, the insertion losses between the input and the output ports, the crosstalk and the split ratio for the device. (2+2+2+2)

b) What is splicing in fiber? Explain different types of techniques use for splicing the optical fiber with neat diagram. (2+6)

Unit - IV

4. a) A trigonometric measurement is performed in order to determine the numerical aperture of a step index fiber. The screen is positioned 10 cm from the fiber end face. When illuminated from a wide angled visible source the measured output pattern size is 6.2 cm. calculate numerical aperture of fiber. (08)

b) Describe the cut back method for attenuation measurement in the laboratory. Explain its advantage and disadvantages. (08)

(OR)

a) What is the need of Optical Time Domain Reflectometry (OTDR) in optical fiber communication? Explain the process of fault location identification with neat graph and diagram. (3+5)

b) Explain the working of laser based system for measurement of distance with neat diagram. (08)

Unit - V.

5. a) Describe the Wavelength division multiplexing (WDM) and compare with Dense wavelength division multiplexing (DWDM). (4+4)

b) What is the object of optical amplifiers? Explain Erbium doped fiber amplifier (EDFA) with neat diagram. (2+6)

(OR)

5. a) Explain the Mach-Zehnder interferometric sensor for fiber optics. (08)

b) Describe the applications of fiber optics in industries, military and computer drives. (2+3+3)