2002 SCHEME

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EC82

Eighth Semester B.E. Degree Examination, December 2010
Optical Fiber Communication

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions.***

1 a. What are the advantages of optical fiber communication system? **(06 Marks)**

b. Explain with necessary diagrams, the different types of fiber structures. **(08 Marks)**

c. A lightwave is traveling in a semiconductor medium (GaAs) of refractive index 3.6. It is incident on a different semiconductor medium (ALGaAs) of refractive index 3.4 and the angle of incidence is 80°. Will this result in total internal reflection? Comment on this result. **(06 Marks)**

2 a. Discuss the following parameters for optical fibers:
i) Absorption ii) Waveguide dispersion iii) Material dispersion iv) Bending loss. **(12 Marks)**

b. Explain the term mode coupling in optical fiber. **(04 Marks)**

c. Find the radius of curvature R at which the number of modes decreases by 50 percent in a graded index fiber. For this fiber $\alpha = 2$, $n_2 = 1.5$, $\Delta = 0.01$, $a = 25\ \mu m$ and wavelength of guided light is $1.3\ \mu m$. **(04 Marks)**

3 a. Explain the operation of an edge-emitting double-heterojunction LED, with neat schematic diagram. **(06 Marks)**

b. Derive an expression for internal quantum efficiency of LED and also an expression for optical power generated internally in LED. **(06 Marks)**

c. A GaAs laser operating at 850 nm has a 500μm length and a refractive index n = 3.7. What are the frequency and wavelength spacing? **(04 Marks)**

d. Give comparison between PIN diode and Avalanche photodiode. **(04 Marks)**

4 a. Show that P_{LED}, Step $= P_s (NA)^2$ for $r_s \leq a$. **(10 Marks)**

b. Describe the different types of mechanical misalignment between the two joined fibers. **(06 Marks)**

c. The end faces of two optical fibers with core refractive indices of 1.50 are perfectly aligned and have a small gap between them. This gap is filled with a gel having a refractive index of 1.30. Find the optical loss in decibels at this joint. **(04 Marks)**

5 a. With a schematic diagram, explain the working of optical receiver. **(08 Marks)**

b. Discuss the possible sources of noise in optical receiver. **(06 Marks)**

c. Discuss the different types of pre-amplifiers in optical receiver. **(06 Marks)**

6 a. Explain the basic elements of an analog link with different noise contribution. **(08 Marks)**

b. What is subcarrier multiplexing? Explain briefly. **(04 Marks)**

c. Explain link power budget and system rise time budget analysis. **(08 Marks)**

7 a. For a multimode fiber link following parameters are recorded:

i) LED with drive circuit has rise time of 15 ns.
ii) LED spectral width = 40 nm
iii) Material dispersion related rise time degradation = 21 ns over 6 km link.
iv) Receiver bandwidth = 25 MHz.
v) Modal dispersion rise time = 3.9 nsec.

Calculate the system rise time. **(06 Marks)**

b. Discuss the different types of line codes optical fiber communication. **(06 Marks)**

c. With a diagram, explain the structure of 2×2 fiber coupler. Also, discuss the construction of 8×8 star coupler formed by interconnecting twelve 2×2 couplers. **(08 Marks)**

8 a. A 32×32 star coupler is formed by interconnecting 2×2 couplers. If 5 percent of power is lost in each coupler element, determine the total loss in the coupler. **(05 Marks)**

b. Write short notes on the following :

i) Wavelength division multiplexing
ii) Optical amplifiers
iii) Photonic switching. **(15 Marks)**

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