USN | | | | | | | | | | |

06EC72

Seventh Semester B.E. Degree Examination, December 2011
Optical Fiber Communication

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Enlist the advantages of optical fibers, compared to the usage of a copper cables in the communication. **(06 Marks)**

b. With relevant diagrams, explain the different types of optical fibers, considering the number of the modes and material composition of the core. **(08 Marks)**

c. Light traveling in air strikes a glass plate at an angle $\theta_1 = 33^\circ$, where θ_1 is measured between the incoming ray and glass surface. If the refracted and reflected beams make an angle of 90° with each other, what is the refractive index of the glass? What is the critical angle? **(06 Marks)**

2 a. Explain the mechanisms which cause absorption in the optical fibers. Mention the measures which can reduce this type of signal degradation. **(06 Marks)**

b. Prove that, delay difference between the axial ray and extreme meridional ray is $\delta T_s \cong \frac{Ln_1\Delta}{c}$. **(08 Marks)**

c. A 6 Km optical link consists of multimode step–index fiber, with a core RI of 1.5 and relative index difference of 1%. Estimate, **(06 Marks)**

i) Delay difference between slowest and fastest modes at the fiber output
ii) rms pulse broadening due to intermodal dispersion on the link
iii) Maximum bit rate that may be obtained without substantial errors on the link assuming only intermodal dispersion.

3 a. Draw and explain the cross – sectional view of a typical GaAlAs double heterostructure LED, along with the energy band diagrams and variations in RI profile. **(10 Marks)**

b. What is quantum efficiency? How are the 'responsivity' and 'quantum efficiency' related? **(04 Marks)**

c. A given silicon avalanche photodiode has a quantum efficiency of 65% at a wavelength of 900nm. Suppose 0.5μW of optical power produces a multiplied photocurrent of 10μA, find the primary photocurrent and the multiplication factor. **(06 Marks)**

4 a. List and sketch the different types of splicing techniques and connectors. **(08 Marks)**

b. What are the principal requirements of a good connector design? **(06 Marks)**

c. A single mode fiber has a normalized frequency V = 2.40, a core RI $n_1 = 1.47$, a cladding RI of $n_2 = 1.465$ and a core diameter of 9μm. Find the insertion loss of a fiber joint, if the lateral offset is 1μm. Also find the loss, if there is an angular misalignment of 1° at a 1300nm wavelength. **(06 Marks)**

PART – B

5 a. Explain with a neat diagram, the basic sections and operations of an optical receiver. **(06 Marks)**

b. Briefly explain the 'quantum limit'. **(04 Marks)**

c. Derive the equation for the performance fidelity of an analog receiver. Substantiate that for large optical signals, SNR represents the quantum limit for receiver sensitivity. **(10 Marks)**

6 a. With a relevant diagram, discuss the subcarrier multiplexing technique. **(06 Marks)**

b. Discuss the various parameters involved in optical link power budget, with the relevant equations. **(06 Marks)**

c. Write short notes on:

i) Mode – partition noise

ii) Chirping. **(08 Marks)**

7 a. Describe the operational principles of WDM, depicting the implementation of a typical WDM network containing various types of optical amplifiers. **(08 Marks)**

b. Explain briefly the working of thin – film resonant cavity filter. What is the application? **(06 Marks)**

c. What is MEMS technology? With an example, explain a MEMS actuation method. **(06 Marks)**

8 a. With relevant schematic diagrams, explain the three possible configurations of a EDFA. **(06 Marks)**

b. Discuss the physical layer aspects of SONET, explaining the basic structure of an STS–L SONET frame. **(06 Marks)**

c. What is the difference between fixed OADM and ROADM? List the features of ROADM. **(08 Marks)**

* * * * *