Seventh Semester Examination -2009

COMMUNICATION SYSTEMS

Full Marks - 70

Time : 3 Hours

Answer Question No. 1 which is compulsory and any five from the rest'

The figures in the right-hand margin indicate marks.

1. Answer the following questions : [2x10

   (a) What is meant by single mode step index fiber ?

   (b) The average optical power lunched into a 10 krn length of the fiber is $100\mu W$ and the average output power is $2.5\mu W$. Calculate signal attenuation per km of this fiber.

   (c) How dispersion shifted fiber is diferent from dispersion flattened fiber ?

   (d) Differentiate connector to that of a splice. In which case loss is minimum ?

   (e) What is EDFA ? What is its role in optical communication ?

   (f) What is semi latus rectum ? What is the relation between semi major axis and semilatus rectum ?

   (g) What is limit of visibility ? What is the condition for geosynchronous orbit ?

(h) What are the orbital effects in communication system performance ?

(i) Write a relation between noise figure and noise temperature.

(j) What is Faraday rotation ? What is its significance ?

2. (a) What is V-Parameter in an optical Fiber ? Write down an expression for it. A multimode optical fiber has a core diameter of $60\mu m$ and relative core cladding refractive index difference of 1.5%. It operates at the wavelength of $0.85\mu m$. Core refractive index is 1.46. Calculate (i) refractive index of the cladding (ii) V-number. (iii) Total number of guided modes in the fiber. (5

(b) Sketch the intenssity distribution of electric field for LP_{01}, LP_{11}, and LP_{62} modes. (3

(c) At what wavelength total dispersion in a fiber becomes zero.Is it the same wavelength where the attenuation is also zero ? (2

3. (a) What is a double heterostructure ? Explain the mechanisms of scarrier confinement and optical confinement, by using this structure for LED (Light emitting diode). What is the basic difference between a LD and LED ? (5

(b) What is a photomultiplier tube ? why this is not suitable for photo-detection ? Explain the working principle of APD . (5

4. (a) Consider a circular LED source with a $62.5\mu m$

diameter. Calculate the Coupling efficiency into 100/140 SIN Fiber with N.A.=0.20. (4

(b) What is the allowable axial displacement, if the coupling loss is to be less than 0.5dB ? Core diameter is $50\mu m$. (3

(c) Briefly explain how the refractive index profile is controlled during fabrication of optical fiber using double crucible method. (3

5. (a) Explain power budget and band width budget for designing a point to point optical Communication link . (5

(b) The 10 to 90% rise time for possible components to be used in direct itensity modulation analog optical fiber link are specified below :

Source (LED) 10ns

Fiber cable : intermodal = 9 ns/km and intramodal = 2 ns/km

Detector (APD) 3 ns

The desired link length without repeaters is 5 km and the required optical bandwidth is 6 MHz. Determine whether the above combination of components give an adequate temporal response. (5

6. (a) Explain TT & C with neat block diagram. (5

(b) Expain significance of G/T ratio on system performance. (5

7. (a) A satellite at a distance of 40,000 km from a point on the earth's surface rasdiates a power of 3 W

from an antenna with a gain of 18 dB in the direction of the earth station.Find the flux density at the receiving point and the power received by an antenna with an effective area of $10m^2$. Find out path loss if it radiates with 11 GHz. (6

(b) Suppose we have 4 GHz receiver with the following gains and noise temperatures

$T_{in} = 50K, T_{RF} = 50K, T_m = 500K, T_{IF} = 1000K$

and $G_{RF} = 23dB, G_m = 0dB, G_{IF} = 30dB$. Calcualte equivalent system noise temperature. (4

8. (a) Differentiate multiple access anfmultiplexing.Explain about CDMA. (5

(b) Explain Propagation effects on satellite link performance due to hydrometric anf nonhydrometric parameters. (5

Seventh Semester Ex