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

06EC72

Seventh Semester B.E. Degree Examination, Dec.2015/Jan.2016
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. Describe any five important advantages of optical fiber communication over other communication. **(10 Marks)**

b. The velocity of light in the core of a step index fiber is 2.01×10^8 m/sec, and the critical angle at the core – cladding interface is 80°. Determine the numerical aperture and the acceptance angle for the fiber in air assuming it has a core diameter suitable for consideration by ray analysis. The velocity of light in vaccum is 2.998×10^8 m/sec. **(06 Marks)**

c. Distinguish between step index and graded index fibers. **(04 Marks)**

2 a. Differentiate between intrinsic and extrinsic absorption of optical power in optical fibers. **(06 Marks)**

b. A step – index single – mode fiber has a core diameter of 8 micron and core refractive index of 1.5. The relative refractive index difference is 0.3% and the operating wavelength is 1.55 micron. Estimate the critical radius of curvature at which large bending losses occur. (Take cutoff normalized frequency $V_C = 2.405$). **(06 Marks)**

c. Draw the diagrams showing pulse – broadening due to inter – modal dispersion in multi – mode step index fiber, multi – mode graded index fiber and single – mode step – index fiber and explain the phenomenon. **(08 Marks)**

3 a. Show that the optical power generated interaually to LED (Pin) is equal to $(\eta_{int} \cdot h \cdot c \cdot I)/(q \cdot \lambda)$ where η_{int} is internal efficiency, h is Planck's constant, C is velocity of light in vaccum and I is the current injected into LED. **(08 Marks)**

b. Starting from rate equations, derive the expression for the number of photons /unit volume resulting from stimulated and spontaneous emissions in LASER diode. **(12 Marks)**

4 a. Describe the different lensing schemes for coupling improvement with the help of neat sketches. **(06 Marks)**

b. Write a note on fiber end – face preparation. **(06 Marks)**

c. Explain with neat sketches, the fusion splicing and V-groove splicing techniques. **(08 Marks)**

PART – B

5 a. Draw the block diagram of optical data link between transmitter and receiver showing the signal path and describe. **(10 Marks)**

b. Draw the generic structure diagrams of high impedance amplifier and transimpidance amplifier and explain them. **(10 Marks)**

6 a. Sketch the optical power loss model diagram for a point – to- point link indicating the losses at connectors at splices and in fiber. Also discuss the link power budget as applicable to this link. **(10 Marks)**

b. With the necessary diagram of a generic RF – over – fiber link explain its performance interms of the gain and noise figure. **(10 Marks)**

7 a. Discuss the operational principles and implementation of WDM with a neat diagram. **(10 Marks)**

b. Sketch the cross-sectional view of a fused – fiber coupler indicating coupling and tapered regions and explain its working. **(10 Marks)**

8 a. Draw the energy – level diagram indicating the transition processes in erbium – doped silica fiber amplifier and explain the amplification mechanism. **(10 Marks)**

b. With the architecture diagram of a four – fiber bidirectional line switched ring (BLSR), explain its working. **(10 Marks)**

* * * * *