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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 (P_{in}) 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 transimpedance amplifier and explain them. (10 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and/or equations written eg. 42+8 = 50, will be treated as malpractice.

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- 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)

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