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10EC/TE72

Seventh Semester B.E. Degree Examination, Dec.2018/Jan.2019

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. Draw and explain the detailed block diagram of optical fiber communication system over other general type of communication system. List its advantages and disadvantages. **(10 Marks)**

b. What is numerical aperture and acceptance angle? Derive an expression for numerical aperture and maximum acceptance angle in the case of a step index optical fiber in terms of refractive indices of core and cladding material. **(06 Marks)**

c. Calculate the number of modes at 850 nm and 1.2 μm in a GRIN fibre with a parabolic-index profile, $\alpha = 2$, with core radius = 25 μm, $n_1 = 1.5$ and $n_2 = 1.49$. **(04 Marks)**

2 a. Discuss the importance of signal attenuation. Explain the three main mechanisms which cause absorption loss of optical energy in fiber. **(08 Marks)**

b. A continuous 12 km long optical fiber link has a loss of 1.5 dB/km.
i) What is the minimum optical power level that must be launched into the fiber to maintain as optical power level of 0.3 μW at the receiving end?
ii) What is the required input power if the fiber has a loss of 2.5 dB/km? **(04 Marks)**

c. Explain the various types of chromatic dispersion which results from the finite spectral line width of the optical source. **(08 Marks)**

3 a. Derive the expression for internally generated power and efficiency in a LED. **(08 Marks)**

b. Give the comparison between PIN diode and APD considering the different parameters. **(06 Marks)**

c. A planar LED is fabricated from gallium arsenide which has a refractive index of 3.6.
i) Calculate the optical power emitted into air as a percentage of the internal optical power for the device when the transmission factor at the crystal-air interface is 0.68.
ii) When the optical power generated internally is 50% of the electric power supplied, determine the external power efficiency. **(06 Marks)**

4 a. Define Fiber Optic Splice. With the help of neat diagram, explain any two types of splicing techniques. **(07 Marks)**

b. List and explain the principle requirements of a good connector design. **(04 Marks)**

c. Explain the concepts of mechanical misalignment, fiber related losses and fiber-end-face preparation with respect to fiber-to-fiber joints. **(09 Marks)**

PART – B

5 a. Explain with help of neat diagram, how the eye diagram is powerful measurement tool for assessing data handling ability in a digital transmission system. **(10 Marks)**

b. Describe the working principles of Burst Mode Receiver and Analog Receiver. **(10 Marks)**

6 a. What is rise time budget? Derive an expression for total system rise time budget. **(10 Marks)**
b. Explain mode-partition noise and chirping. **(10 Marks)**

7 a. With the help of a neat schematic diagram, explain the operational principle of WDM system with multiplication in capacity of system. **(10 Marks)**
b. Describe the working of Dynamic Gain Equaliser and Optical add/drop Multiplexers (OADM). **(10 Marks)**

8 a. List the three possible configurations of an EDFA. With relevant diagram explain any one of them. Also derive an expression for EDFA power conversion efficiency and gain. **(10 Marks)**
b. With relevant diagrams, explain the basic formats of an STS-N SONET frame, STM-N SDH frame, two fiber UPSR and four fiber BLSR. **(10 Marks)**

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