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Question Paper Code : 71745

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2017.

Seventh Semester

Electronics and Communication Engineering

EC 6702 — OPTICAL COMMUNICATION AND NETWORKS

(Regulations 2013)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are the advantages of optical fiber?

2. A multimode silica fiber has a core refractive index $n_1 = 1.48$ and cladding refractive index $n_2 = 1.46$. Find the numerical aperture of fiber.

3. What is intra modal dispersion?

4. Define group delay.

5. What is minimum detectable optical power?

6. Compare the optical sources : LASER AND LED.

7. What are the methods employed for measuring attenuation in optical fiber.

8. Define bit error rate.

9. What is an optical layer?

10. What are the key parameters required for analysing the optical link?

PART B — (5 × 16 = 80 marks)

11. (a) (i) A step index multimode fiber with a numerical aperture of 0.2 support approximately 1000 modes at an 850 nm wavelength. What is the diameter of its core? How many modes does the fiber supports at 850 nm and 1550 nm? (8)

(ii) Draw the block diagram of optical fiber transmission link and explain. (8)

Or

(b) (i) Find the core radius necessary for single mode operation at 1320nm of a step index fiber with n_1 =1.48 and n_2 = 1.478. Determine the numerical aperture and acceptance angle of this fiber. (7)

(ii) Derive the wave equations for a crylindrical fiber. (9)

12. (a) What are the causes of signal attenuation in optical fiber? Explain about it detail. (16)

Or

(b) Derive an expression for pulse broadening in graded index fiber. (16)

13. (a) Discuss about surface emitting LED and edge emitting LEG with neat sketch. (16)

Or

(b) Explain about different types of lensing schemes used in improving the efficiency of light emitting diode. (16)

14. (a) Discuss in detail about the methods used for measuring intermodal dispersion and chromatic dispersion. (16)

Or

(b) Explain about the operation of an optical receiver and source of error during transmission. Draw the configuration of receiver. (16)

15. (a) (i) An engineer has the following components available :

* GaAlAs laser diode, operating at 850 nm, fiber coupled power 0 dBm
* Ten sections of cable each of which is 500 m long, has 4 dB/km attenuation, has connectors at both ends
* 2 dB/connector connector loss
* A PIN photodiode receiver, –45 dBm sensitivity
* An avalanche photodiode receiver, –56 dBm sensitivity

The engineer wishes to construct a 5-km link operating at 20 Mb/s. Analyze which receiver should be used if a 6-dB Operating margin is required.

(ii) Discuss about the principle of optical code division multiple access. (8)

Or

(b) (i) An optical fiber system is to be designed to operate over an 8 km length without repeaters. The rise times of the chosen components are : (8)

(1) Source (LED) 8 ns

(2) Fiber: intermodal 5 ns km-1

(3) (pulse broadening) intramodal 1 ns km-1

(4) Detector (*p-i-n* photodiode) 6 ns

From system rise time considerations estimate the maximum bit rate that may be achieved on the link when using an NRZ format.

(ii) Discuss about the protection mechanism in UPSR and BLSR ring architecture with neat sketch. (8)