

Reg. No. :



**Question Paper Code : 31377**

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2013.

Seventh Semester

Electronics and Communication Engineering

EC 2402/EC 72/10144 EC 702 – OPTICAL COMMUNICATION AND NETWORKING

(Regulation 2008/2010)

(Common to PTEC 2402 – Optical Communication and Networking for B.E. (Part-Time) Sixth Semester – Electronics and Communication Engineering – (Regulation 2009))

Time : Three hours

Maximum : 100 marks

Missing data may be suitably assumed.

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. The refractive indexes of the core and cladding of a silica fiber are 1.48 and 1.46 respectively. Find the acceptance angle for the fiber.
2. Determine the normalized frequency at 820 nm for a step-index fiber having a 25  $\mu\text{m}$  radius. The refractive indexes of the cladding and the core are 1.45 and 1.47 respectively. How many modes propagate in this fiber at 820 nm?
3. A continuous 12 kms-long optical fiber link has a loss of 1.5 dB/km. What is the minimum optical power that must be launched into the fiber to maintain an optical power level of 0.3  $\mu\text{W}$  at the receiving end?
4. Define dispersion in multimode fibers. What is its effect?
5. Write two differences between a Laser diode and a LED.
6. For a photodiode define quantum efficiency- $\eta$  and responsivity - R.
7. A digital fiber optic link operating at 1310 nm, requires a maximum BER of  $10^{-8}$ . Calculate the required average photons per pulse.
8. The photo detector output in a cutback-attenuation set up is 3.3 V at the far end of the fiber. After cutting the fiber at the near end, 5m from the far end, photo detector output read was 3.92 V. What is the attenuation of the fiber in dB/Km?

9. Obtain the transmission bit rate of the basic SONET frame in Mbps.
10. Illustrate interchannel cross talk that occurs in a WDM system.

PART B — (5 × 16 = 80 marks)

11. (a) (i) With the help of a block diagram explain the different components of a optical fiber link. (12)
- (ii) Compare the optical fiber link with a satellite link. (4)

Or

- (b) (i) Explain the differences between meridional and skew rays. (4)
- (ii) Bring out the differences between phase and Group velocities. (6)
- (iii) Deduce an expression for NA of a fiber with the help of a neat figure showing all the details. (6)
12. (a) (i) Discuss the attenuation encountered in optical fiber communication due to :

- (1) Bending
- (2) Scattering
- (3) Absorption. (12)

- (ii) Calculate the maximum transmission distance for a fiber link with an attenuation of 0.2 dB/Km if the power launched is 1mW and the receiver sensitivity is 50  $\mu$ W. Calculate the attenuation for an other link with same parameters and the distance of 26 Kms. (4)

Or

- (b) (i) Clearly bringout the differences between intra and inter modal dispersion. (12)
- (ii) Find the maximum bit rate for the fiber link of 5 Kms. The numerical aperture is 0.25 and the refractive index is 1.48. (4)
13. (a) (i) Explain the working of  $n$  hetero structure LED. (10)
- (ii) Define Internal quantum efficiency of a LED. Deduce the expression for the same. (6)

Or

- (b) (i) What do you understand by optical-wave-confinement and current confinement in LASER diode? Explain with suitable structures. (10)
- (ii) Briefly explain the different noise sources of a photo detector. (6)

14. (a) (i) Explain any two types of preamplifiers used in a receiver. (12)
- (ii) Define the terms - 'Quantum limit' and 'Probability of Error' with respect to a receiver with typical values. (4)

Or

- (b) (i) Explain the 'Insertion-Loss method' used for attenuation measurement. (8)
- (ii) Explain the technique used in 'Frequency - Domain Intermodal Dispersion measurement'. (8)
15. (a) (i) What is a 'four-fiber BLSR' ring in a SONET? Explain the reconfiguration of the same during node or fiber failure. (8)
- (ii) What is 'broadcast-and-select multihop network'? Explain. (8)

Or

- (b) (i) Explain the following requirements for the design of an optically amplified WDM link :
- (1) Link Band width
- (2) Optical power requirements for a specific BER. (8)
- (ii) Write a note on solitons. (8)