Reg. No. ☐☐☐☐☐☐☐☐☐☐☐☐☐

Question Paper Code	12185

B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2023
Seventh Semester
Electronics and Communication Engineering
EC8751 - OPTICAL COMMUNICATION
(Regulations 2017)

Duration: 3 Hours   Max. Marks: 100

PART - A (10 × 2 = 20 Marks)
Answer ALL Questions

Marks,
K-Level, CO

1. What is a linearly polarized mode?   *2,K2,CO1*

2. Calculate the critical angle of incidence of two substances with different   *2,K2,CO1*
   refractive indices, where $n_1=1.5$ and $n_2=1.46$.

3. List the different mechanisms which cause absorption.   *2,K1,CO2*

4. Define –Dispersion in optical fibers.   *2,K1,CO2*

5. Why silicon is not used to fabricate LED or Laser diode?   *2,K1,CO3*

6. What is population inversion?   *2,K2,CO3*

7. Define responsivity of photodiode.   *2,K1,CO4*

8. A digital fiber optic link operating at 850nm requires a minimum BER of   *2,K2,CO4*
   10^{-9}.Calculate the required average photons per pulse.

9. What are the different techniques for fiber diameter measurement?   *2,K2,CO5*

10. State the significance of maintaining the fiber outer diameter constant.   *2,K1,CO5*

PART - B (5 × 13 = 65 Marks)
Answer ALL Questions

11. a) (i) With the help of a block diagram explain the different components   *8,K2,CO1*
        of an optical fiber link.
        (ii) Deduce an expression for NA of a SI fiber with the help of a neat   *5,K2,CO1*
        figure showing all the details.
                                    OR
    b) (i) Draw the structures of single and multimode step index and graded   *8,K2,CO1*
        index fiber with their typical dimensions.
        (ii) Mention the advantages of optical fiber communication systems.   *5,K1,CO1*

12. a) Derive the expressions for material and waveguide dispersion and   *13,K2,CO2*
        explain them.
                                    OR
    b) (i) Consider a 10 Km optical fiber link using a multimode step index   *9,K2,CO2*
        fiber with following parameters: core refractive index is 1.458; relative

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create   *12185*

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index deviation is 0.002.Estimate the delay time difference between the axial ray and the most oblique ray. What is the value of RMS pulse broadening due to intermodal dispersion and maximum bit rate of transmission?

(ii) Give short notes on mode coupling in optical fiber communication. *4,K2,CO2*

13. a) (i) Draw the structures of SLED and ELED. Explain the principle of operation. *6,K2,CO3*

(ii) A double-heterojunction InGaAsP LED emitting at a peak wavelength of 1310nm has radiative and non-radiative recombination times of 30ns and 100ns respectively. If the drive current is 40mA, determine internal quantum efficiency and internal power. *7,K2,CO3*

OR

b) Draw and explain the structure of Fabry-Perot resonator cavity for a Laser Diode. Derive Laser diode rate equations. *13,K2,CO3*

14. a) Explain the structure and working of a silicon PIN and Avalanche photo diode. *13,K2,CO4*

OR

b) Estimate the terms: - Quantum limit and Probability of error with respect to a receiver with typical values. *13,K2,CO4*

15. a) Explain the various methods used for Fiber attenuation measurements. *13,K2,CO5*

OR

b) (i) Explain the different issues and consideration involved in coupling the optical sources to optical fibers. *8,K2,CO5*

(ii) Explain the expanded beam connector with necessary diagrams. *5,K2,CO5*

PART - C (1 × 15 = 15 Marks)

16. a) An Engineer has the following components available: *15,K3,CO6*

 a) GaAlAs laser diode, operating at 850 nm,fiber coupled power 0dbm
b) Ten sections of cable each of which is 500 m long, has 4dB/km attenuation has connectors at both ends
c) 2dB/connector connector loss
d) A PIN photodiode receiver, -45 dBm sensitivity
 e) An avalanche photodiode receiver,-56dBm sensitivity.
The engineer wishes to construct a 5 km link operating at 20 Mb/s. Estimate which receiver should be used if a 6 dB operating margin is required.

OR

b) (i) Explain principles of solitons and discuss the soliton parameters with necessary expressions and diagrams. *7,K2,CO6*

(ii)Demonstrate SONET layers and frame structure with diagram. *8,K2,CO6*