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Question Paper Code : 70447

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2021.

Seventh Semester

Electronics and Communication Engineering

EC 6702 – OPTICAL COMMUNICATION AND NETWORKS

(Regulations 2013)

(Common to : PTEC 6702 Optical Communication and Networks for B.E. (Part-Time) - Electronics and communication Engineering - Sixth Semester (Regulations 2014))

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. What are the conditions for total internal reflection?

2. Distinguish meridional rays from skew rays.

3. Distinguish between intramodal and intermodal dispersion.

4. Why graded index is less affected by dispersion than step index multimode optical fiber?

5. Why carrier confinement and optical confinement are used in LED?

6. What is Lambertian pattern?

7. What are mode scramblers or mode filters?

8. State the significance of maintaining the fiber outer diameter constant.

9. Define power penalty.

10. Consider a spectral band of 0.8 nm (or equivalently, a mean frequency spacing of 100 GHz at a 1550 nm wavelength) within which lasers with narrow line widths are transmitting. How many of such signal channels fit into the C band?

PART B — ($5 \times 13 = 65$ marks)

11. (a) Draw the block diagram of an optical fiber link transmission and explain the different components. (13)

Or

(b) With relevant diagrams, explain the different types of fibers, considering number of modes and material composition of the core. (13)

12. (a) Explain the dispersion shifted and dispersion flatted fibers. Why do we need such fibers and how these fibers are made? (13)

Or

(b) Describe the attenuation mechanisms in an optical fiber. (13)

13. (a) Draw and explain the structure of Fabry Perot resonator cavity for a Laser diode. Also derive the LASER rate equations for steady state output. (13)

Or

(b) Explain in detail fiber to fiber joints and their losses with neat diagram. (13)

14. (a) (i) Express the technique used in frequency-domain intermodal dispersion measurement. (7)

(ii) Give main idea about 'Insertion-Loss method' used for attenuation measurement. (6)

Or

(b) (i) Explain in detail about the front end optical amplifiers. (7)

(ii) Describe about fiber refractive index profile measurement in detail. (6)

15. (a) (i) An Engineer has the following components available at 850 nm

(1) GaAlAs laser diode with 0 dBm fiber coupled power

(2) Silicon avalanche photodiode with -51 dBm sensitivity

(3) Graded index fiber with 3.5 dB/km attenuation

(4) Connector with loss of 1 dB/connector.

What is the maximum transmission-distance that can be covered if he designs an optical link using the above components? Justify your answer. (7)

(ii) Demonstrate SONET layers and frame structure with diagram. (6)

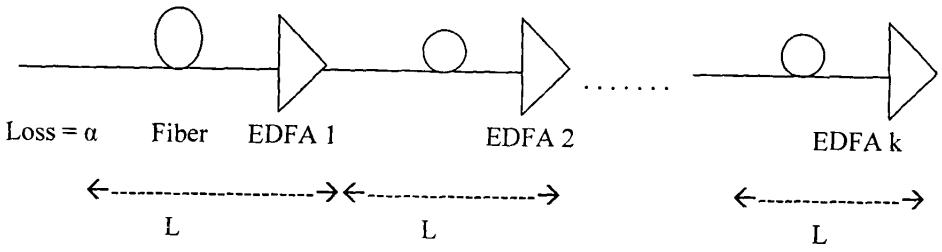
Or

(b) (i) A 2×2 biconical tapered fiber coupler has an input optical power level of $P_0 = 200\ \mu W$. The output powers at the other three ports are $P_1 = 90\mu W, P_2 = 85\mu W$ and $P_3 = 6.3\ nW$. What are the coupling ratio and return loss for this coupler? (6)

(ii) Explain WDM operational principle in detail with neat diagram. (7)

PART C — ($1 \times 15 = 15$ marks)

16. (a) Consider a cascaded chain of k fibers plus EDFA combinations as shown in figure 1.



(i) Show that the path average signal power is $< P >$ path $= P_s$, in $[(G-1)/(G.\ln(G))]$. (10)

(ii) Derive the path average ASE power. (5)

Or

(b) A soliton transmission system operates at 1550 nm with fiber that have a dispersion of 1 .5 ps/(nm.km) and an effective core area of $50\ \mu m^2$.

(i) Find the peak power required for fundamental solitons that have a 16 ps FWHM width. Use the value $n_2 = 2.6 \times 10^{-16}\ \ cm^2/w$. (5)

(ii) What are the dispersion length and the soliton period? (5)

(iii) What is the required peak power for 30 ps pulses? (5)

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