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Question Paper Code : 52927

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2019.

Seventh Semester

Electronics and Communication Engineering

EC 6702 – OPTICAL COMMUNICATION AND NETWORKS

(Regulation 2013)

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

Time : Three hours | Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Why do we prefer step index single mode fiber for long distance communication?

2. What is the necessity of cladding for an optical fiber?

3. A fiber has an attenuation of 0.5 dB/ km at 1500 nm. If 0.5mW of optical power is initially launched into the fiber, estimate the power level after 25 km.

4. Give the measure of information capacity in optical wave guide.

5. Why silicon is not used to fabricate LED or Laser diode?

6. A GaAs laser operating at 850 nm has a 500 μm length and a refractive index of n = 3.7. What are the frequency spacing and the wavelength spacing?

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

8. What is the significance of intrinsic layer in PIN diodes?

9. Distinguish between fundamental and higher order solitons.

10. What is EDFA?

PART B — (5 × 13 = 65 marks)

11. (a) (i) Draw and explain the refractive index profile and ray transmission in multimode step index and single mode step index fibers. (7)

(ii) Consider a multimode step index fiber with a 62.5 μm core diameter and a core cladding index difference of 1.5 percent. If the core refractive index is 1.480, estimate the normalized frequency of the fiber and the total number of modes supported in the fiber at a wavelength of 850 nm. (6)

Or

(b) (i) Explain in detail linearly polarized modes in optical fibers and their relationship to V number. (7)

(ii) Consider a fiber with a 25 μm core radius, a core index $n_1 = 1.48$ and $\Delta = 0.01$.

(1) If $\lambda = 1320$ nm, what is the value of V number and how many modes propagate in the fiber? (2)

(2) What is the % of optical power that flows in the cladding? (2)

(3) If the core cladding difference is reduced to $\Delta = 0.003$, how many modes does the fiber have and what fraction of the optical power flows in the cladding? (2)

12. (a) (i) How does waveguide dispersion affect the performance of the transmission in an optical fiber? Explain in detail. (7)

(ii) A manufacture's data sheet lists the material dispersion D_{mat} of GeO_2 doped fiber to be 110 ps/(nm.km)at a wavelength of 860 nm. Find the rms pulse broadening per kilometer due to material dispersion if the optical source is a GaA1As LED that has a spectral width $\sigma\lambda$ of 40 nm at an output wavelength of 860 nm. (6)

Or

(b) (i) Discuss about the intermodal dispersion that occurs in a multimode graded index fiber. (7)

(ii) A continuous 12 km long optical fiber link has a loss of 1.5 dB/km. Propose a proper solution to find the minimum optical power that must be launched into the fiber to maintain the optical power level of 0.3 μw at the receiving end. (6)

13. (a) (i) With diagram, explain surface and edge emitting LED structures. (7)

(ii) A double heterojunction InGaAsP LED emitting at peak wavelength of 1310 nm has radiative and non-radiative recombination times of 30ns and 100 ns, respectively. The driver current is 40 mA. Find the

(1) bulk recombination time (2)

(2) internal quantum efficiency and (2)

(3) Internal Power level (2)

Or

(b) Draw and Explain the structure of Fabry Perot resonator cavity for a Laser diode. Derive Laser diode rate equation. (13)

14. (a) Develop the schematics of pin photodiode and APD and also explain in detail.

Or

(b) A given silicon avalanche photodiode has a quantum efficiency of 65 percent at a wavelength of 900nm. Suppose 0.5 μW of optical power produces a multiplied photocurrent of 10 μA, What is the multiplication factor M?

15. (a) Explain in brief the blocks and their functions of an optical receiver with schematic diagrams.

Or

(b) Define and explain the principle of WDM networks.

PART C — (1 × 15 = 15 marks)

16. (a) Present the design procedure of a SONET network and suggest a frame work in detail.

Or

(b) State and discuss on the no linear effects on an optical network.