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Question Paper Code : 55349

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2011.

Seventh Semester

Electronics and Communication Engineering

EC 2402 — OPTICAL COMMUNICATION AND NETWORKING

(Regulation 2008)

Time : Three hours Maximum : 100 marks

Missing data could be suitably assumed.

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is the energy of a single photon of the light whose λ = 1550 nm, in eV?

2. Assume that there is a glass rod of refractive index 1.5, surrounded by air. Find the critical incident angle.

3. Define the attenuation coefficient of a fiber.

4. Calculate the cut-off wavelength of an optical signal through a fiber with its core refractive index of 1.50 and that of cladding = 1.46. The core radius of 25 μm. The normalised frequency is 2.405.

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

6. Calculate the external differential quantum efficiency of a laser diode operating at 1.33 μm. The slope of the straight line portion of the curve for the emitted optical power P versus drive current I is given by 15 mW/mA.

7. Define 'quantum efficiency' of a photo detector and write the expression.

8. Mention the error sources in fiber optic receiver.

9. What are the three common topologies used for fiber optical network? Give the schematic of any one network?

10. Calculate the number of independent signals that can be sent on a single fiber in the 1525-1565 nm band. Take the spectral spacing as per ITU-T recommendation G.692.

PART B — (5 × 16 = 80 marks)

11. (a) (i) What is numerical aperture of an optical fiber? Deduce an expression for the same. (12)

(ii) Calculate NA of silica fiber with its core refractive index (n_1) of 1.48 and cladding refractive index of 1.46. What should be the new value of 'n_1' in order to change the NA to 0.23. (4)

Or

(b) (i) Explain the phenomenon of total internal reflection using Snell's law with figures and calculations. (12)

(ii) Distinguish step-index from graded index fibers. (4)

12. (a) (i) What do you mean by pulse broadening? Explain its effect on information carrying capacity of a fiber. (12)

(ii) An LED operating at 850 nm has a spectral width of 45 nm. What is the pulse spreading in ns/km due to material dispersion? What is the pulse spreading when a laser diode having a 2 nm spectral width is used? The material dispersion is 90 ps/nm km. (4)

Or

(b) (i) What is meant by 'fiber splicing'? Explain fusion splicing of optical fibers. (8)

(ii) Explain expanded beam fiber connector with a neat schematic. (8)

13. (a) (i) Compare LED with a laser diode. (4)

(ii) With the help of a neat diagram explain the construction and working of a surface emitting LED. (12)

Or

(b) (i) Explain the structure and working of a silicon APD. (12)

(ii) Define S/N ratio of a photodetector. What conditions should be met to achieve a high SNR? (4)

14. (a) (i) Explain the fiber optic receiver operation using a simple model and its equivalent circuit. (8)

(ii) Explain the operation of a pre-amplifier built using a FET. (8)

Or

(b) Explain the measurement technique used in the case of

(i) Numerical aperture

(ii) Refractive index profile

(iii) Fiber cut-off wave length

(iv) Fiber diameter. (16)

15. (a) Explain the architecture of SONET and discuss nonlinear effects on Network performance. (16)

Or

(b) Write short notes on

(i) Wavelength routed networks. (8)

(ii) Optical CDMA. (8)

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