Reg. No. :

Question Paper Code : 11347

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2012.

Seventh Semester

Electronics and Communication Engineering

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

(Regulation 2008)

(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

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Calculate the cutoff wavelength of a single mode fibre with core radius of 4 μm and Δ = 0.003.

2. For a fibre with core refractive index of 1.54 and fractional refractive index difference of 0.01, calculate its numerical aperture.

3. What are the two reasons for chromatic dispersion?

4. What are the most important non-linear effects of optical fibre communication?

5. Compare and contrast between surface and edge emitting LEDs.

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

7. What is dark current?

8. List out the various error sources.

9. What were the problems associated with PDH networks?

10. Enumerate the various SONET/SDH layers.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Starting from the Maxwell's equation, derive the expression for wave equation of an electromagnetic wave propagating through optical fibre. (8)

(ii) Describe the ray theory behind the optical fibre communication by total internal reflection. State the application of Snell's law in it. (8)

Or

(b) (i) A SI fibre with silica-core refractive index of 1.458, V = 75 and NA = 0.3 is to be operated at 820 nm. What should be its core size and cladding refractive index? Calculate the total number of modes entering this fibre. (8)

(ii) Derive expression for the linearly polarized modes in optical fibres and obtain the equation for V number. (8)

12. (a) (i) Describe the linear and non-linear scattering losses in optical fibres. (8)

(ii) An LED operating at 850 nm has a spectral width of 45 mm. 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? (8)

Or

(b) (i) Draw and explain the various fibre alignment and joint losses. (8)

(ii) Write notes on fibre splices and connectors. (8)

13. (a) Draw and explain the structure of Fabry-Perot resonator cavity for a Laser Diode. Derive Laser diode rate equations. (16)

Or

(b) (i) Draw the structure and electric fields in the APD and explain its working. (8)

(ii) What are the three factors that decides the response time of photodiodes? Explain them in detail with necessary sketches. (8)

14. (a) (i) Draw the front end optical amplifiers and explain. (8)

(ii) Considering the probability distributions for received logic 0 and 1 signal pulses, derive the expressions for BER and error function. (8)

Or

(b) Write notes on the following :

(i) Fibre refractive index profile measurement. (8)

(ii) Fibre cut-off wavelength measurement. (8)

15. (a) Discuss the concepts of Media Access Control protocols in Broadcast and select networks. (16)

Or

(b) (i) Describe the non-linear effects on network performance in detail. (8)

(ii) Explain the basics of optical CDMA systems. (8)

$NA = n_1 (2\Delta)^{1/2} \Rightarrow \Delta =$

$\Rightarrow a$ (radius).

$V = \frac{2\pi}{\lambda} a n_1 (2\Delta)^{1/2}$

$\Delta = \frac{n_1 - n_2}{n_1}$ → refractive index

$M = \frac{V^2}{2}$