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Question Paper Code : 20274

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 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. The relative refractive index difference (Δ) for an optical fiber is 1%. Determine the critical angle at the core cladding interface if the core refractive index is 1.46

2. A step index fiber has a normalized frequency (V) of 26.6 at 1300 nm. if the core radius is 25 μm, find the numerical aperture.

3. A 30 km long optical fiber has an attenuation of 0.8 dB/km. If –7 dBm of optical power is launched into the fiber, determine the output optical power in dBm.

4. What factors cause Rayleigh scattering in optical fibers?

5. What are the advantages of LED?

6. Photons of energy 1.53×10^{-19} J are incident on a photodiode which has a responsivity of 0.65 A/W. If the optical power level is 10 μW, find the photocurrent generated

7. Define quantum limit.

8. What are the methods used to measure fiber refractive index profile?

9. Write the functions of transport and path overhead.

10. What are the drawbacks of broadcast and select networks for wide area network applications?

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PART B — (5 × 16 = 80 marks)

11. (a) (i) Draw and explain the acceptance angle and numerical aperture of an optical fiber and derive expressions for both. (8)

(ii) A fiber has a core radius of 25 μm, core refractive index of 1.48 and relative refractive index difference (Δ) is 0.01. If the operating wavelength is 0.84 μm, find the value of normalized frequency and the number of guided modes. Determine the number of guided modes if Δ is reduced to 0.003. (8)

Or

(b) (i) Draw and explain the refractive index profile and ray transmission in single mode and multimode step index fibers and graded index fibers. Write the expressions for the numerical aperture and number of guided modes for a graded index fiber. (8)

(ii) A step index fiber has a core diameter of 7 μm and core refractive index of 1.49. Estimate the shortest wavelength of light which allows single mode operation when the relative refractive index difference for the fiber is 1%. (8)

12. (a) Explain the following with necessary diagram and expressions

(i) Non linear scattering loss and fiber bend loss. (10)

(ii) Material dispersion in optical fiber. (6)

Or

(b) (i) Explain mechanical splices with neat diagrams. (8)

(ii) Write a brief note on fiber alignment and joint loss. (8)

13. (a) (i) Draw and explain surface and edge emitting LEDs. (8)

(ii) Explain any two injection laser structures with neat diagrams. (8)

Or

(b) (i) Explain the operation of APD with neat diagram. (8)

(ii) A silicon p-i-n photodiode incorporated into an optical receiver has a quantum efficiency of 60% when operating at a wavelength of 0.9 μm. The dark current in the device is 3 nA and the load resistance is 4 KΩ. The incident optical power is 200 nW and the post detection bandwidth of the receiver is 5 MHz. Calculate the root mean square (rms) shot noise and thermal noise currents generated. (8)

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14. (a) (i) Discuss the noise and disturbances affecting the optical detection systems. (6)

(ii) Draw and explain the operation of high impedance FET and BJT preamplifiers. (10)

Or

(b) Explain the following measurements

(i) Attenuation measurement using cut back techniques. (8)

(ii) Frequency domain measurement of fiber dispersion. (8)

15. (a) Explain the principle of solitons and discuss the soliton parameters with necessary expressions and diagrams. (16)

Or

(b) Write short notes with necessary diagrams on :

(i) Optical CDMA. (8)

(ii) WDM and EDFA system performance. (8)

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