Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 31285 28th - AN

B.E./B.Tech DEGREE EXAMINATION, MAY/JUNE 2013.

Seventh Semester

Electronics and Communication Engineering

080290058 — OPTICAL FIBER COMMUNICATION

(Regulation 2008)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Calculate the numerical aperture and solid acceptance angle in air for a fiber with core refractive index of 1.46 and core cladding index difference (Δ) = 0.01

2. Write the advantages and disadvantages of multimode optical fibers.

3. Determine the optical power output for a 100 km optical fiber with an attenuation of 0.25 dB/km, if the signal input power is 0.1 mW.

4. Distinguish intramodal and intermodal dispersion.

5. Write the major advantages of LASER diodes as compared with LEDs.

6. What are the materials suitable for fabricating light sources for optical fibers?

7. A photodiode has a quantum efficiency of 60%, when photons of energy 1.5×10^{-19} J are incident upon it. At what wavelength, is the photodiode operating?

8. What is meant by quantum limit?

9. What are the advantages of SONET?

10. Distinguish modal and mode-partition noises.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Draw and explain the structure of step and graded index fibers with expressions for the refractive index profile, numerical aperture and the number of guided modes. (10)

(ii) Calculate the number of modes supported by a graded index fiber having a core radius of 25 μm and operating at 820 nm. The fiber has a refractive index of 1.48 at the core axis and a cladding index of 1.46. Assume a parabolic index profile. (6)

Or

(b) (i) Describe the modal concepts of circular waveguides and linearly polarized modes of optical fibers with necessary diagrams and expressions. (12)

(ii) A multimode step index fiber has a relative refractive index difference (Δ) of 1 % and a core refractive index of 1.5. The number of modes propagating at a wavelength of 1.3 μm is 1100. Determine the diameter of the fiber core. (4)

12. (a) (i) Explain the different factors causing signal attenuation in optical fibers with necessary expressions. (10)

(ii) Write a brief note on polarization mode dispersion. (6)

Or

(b) (i) Describe the factors causing dispersion in single mode optical fibers with necessary expressions. (10)

(ii) Draw and explain the different RI profiles and discuss their impact on signal dispersion. (6)

13. (a) (i) Draw and explain the operation of Fabry-Perot and distributed feedback laser diodes. (10)

(ii) Briefly discuss the modulation of laser diodes and also discuss the impact of temperature on the performance of semiconductor laser diodes. (6)

Or

(b) (i) Explain the important issues involved in source to fiber power launching. Discuss the coupling of LEDs and laser diodes to optical fibers with suitable diagrams and expressions. (10)

(ii) Discuss the methods of improving the source power coupling into optical fibers. (6)

14. (a) (i) Explain the operation of PIN photodetector with necessary diagrams. What are the advantages and disadvantages of APD over PIN photodiode? (8)

(ii) A silicon PIN photodiode has a quantum efficiency of 65% at a wavelength of 0.8 μm. Determine the mean photocurrent when the detector is illuminated with 5 μW of optical power and also the root mean square quantum noise and thermal noise currents at a temperature of 20°C with a post detection bandwidth of 20 MHz. Given Boltzmann's constant $K = 1.38 \times 10^{-23}$ J/K, Planck's constant $h = 6.625 \times 10^{-34}$ J.s and the load resistance is 5.0 Ω. (8)

Or

(b) (i) Draw and explain a digital optical receiver and explain its performance. (8)

(ii) With the receiver model, bring out the advantages of trans impedance pre amplifiers. (8)

15. (a) (i) Describe the power and rise time budget calculations with necessary equations and also discuss their importance. (12)

(ii) Write a brief note on the principle of WDM. (4)

Or

(b) (i) Give a brief note on the concept and applications of solitons. (8)

(ii) Describe the principle of Erbium doped fiber amplifier. (8)

———————