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

Question Paper Code : X65657

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2020
Seventh Semester
Electronics and Communication Engineering
080290058 – OPTICAL FIBER COMMUNICATION
(Regulations 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. When the mean optical power launched into a 10 km length of fiber is 120 μW, the mean optical power at the fiber output is 3 μW ? Determine the signal attenuation per km of the fiber.

4. What are the factors causing polarization mode dispersion in optical fibers ?

5. What is meant by spontaneous emission ?

6. What are the advantages of LEDs over laser diode ?

7. Define responsivity.

8. What are the advantages and disadvantages of PIN photo diode ?

9. List the system requirements needed in analyzing a point-to-point link.

10. Which types of architecture are popular for SONET and SDH Networks ?

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 bending losses, core and cladding losses in detail. **(8)**

ii) Explain design optimization of single mode fiber in detail. **(8)**

(OR)

b) i) A 10 km optical link consists of multimode step index fiber with a core refractive index of 1.48 and a relative refractive index difference of 1%. Estimate the delay difference between the slowest and fastest modes at the fiber output. Deduce the expression used here. **(10)**

ii) A graded index fiber has a core with a parabolic refractive index profile which has a diameter of 50 μm. The fiber has a numerical aperture of 0.2. Estimate the total number of guided modes propagating the fiber when it is operating at a wavelength of 1 μm. **(6)**

13. a) i) Explain the lensing schemes for coupling improvement. **(8)**

ii) Explain the modulation of laser diodes. **(8)**

(OR)

b) i) A double-heterojunction In GaAsP LED emitting at a peak wavelength of 1310 nm has radiative and nonradiative recombination times of 30 and 100 ns respectively. The drive current is 40 mA. Find the bulk recombination lifetime and internal quantum efficiency. **(6)**

ii) Derive the expression to calculate the maximum optical power coupled into a fiber. **(10)**

14. a) Discuss the principle of operation of APD with neat circuit diagram. Also discuss the requirements of photo detector. **(16)**

(OR)

b) i) Explain the fundamental receiver operation in optical communication. **(10)**

ii) Write short notes on the temperature effects on photo detectors. **(6)**

15. a) i) Describe the principle and application of solitons with suitable diagrams and expressions. **(10)**

ii) Explain the link power budget analysis of an optical digital transmission link. **(6)**

(OR)

b) i) Explain the basic concepts of SONET/SDH. **(8)**

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

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