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**Question Paper Code : 80538**

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2024.

Seventh Semester

Electronics and Communication Engineering

EC 8751 – OPTICAL COMMUNICATION

(Common to: Computer and Communication Engineering)

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. List out the advantages of fiber optic communication.

2. Draw the schematic diagram of a fiber-drawing tower and label its parts.

3. Define Rayleigh scattering.

4. Differentiate between Stimulated Brillouin Scattering and Stimulated Raman Scattering.

5. Why Si and Ge are not used for the fabrication of visible light sources?

6. Compare and contrast PIN and APD photodetector.

7. Define quantum limit.

8. Consider an LED that has a circular emitting area of radius 35 $\mu m$ and a Lambertian emission pattern with 150 W/(cm$^2$-sr) axial radiance at a given drive current. Calculate the optical power coupled into a step-index fiber, which has a core radius of 50 $\mu m$ with NA = 0.20.

9. Draw the basic structure of an STS-1 SONET frame and write its transmission bit rate.

10. Define soliton and its types.

PART B — (5 × 13 = 65 marks)

11. (a) (i) Consider a multimode fiber that has a core refractive index of 1.480 and a core-cladding index difference of 2.0% ($\Delta = 0.020$). Find (1) the numerical aperture, (2) the acceptance angle, and (3) the critical angle. (7)

(ii) Consider three multimode step-index optical fibers, each of which has a core index of 1.48 and an index difference $\Delta = 0.01$. Assume the three fibers have core diameters of 50 and 100 $\mu m$. How many modes are in these fibers at a wavelength of 1550 nm? (6)

Or

(b) Explain Vapor Phase Axial Deposition (VAD) method. Why is quality of VAD fibers better than those obtained by using Outside Vapor Deposition (OVD)? (13)

12. (a) A 50 km long optical fiber link operating at 850 nm offers an average attenuation of 0.5 dB/Km. An optical power of 100 $\mu W$ is launched into the fiber at the input. What is the value of the output at a distance of 30 km from the input? Also, express the power in the $\mu W$ and in dBm. What is the output power at the end of the link? (13)

Or

(b) Explain how intersymbol interference affects the bandwidth in optical fiber communication. (13)

13. (a) (i) List out the various requirements that an optical source should ideally meet for use in the transmitter unit of an optical fiber communication system. (7)

(ii) Compare and contrast Light Emitting Diode (LED) and Laser Diode (LD). (6)

Or

(b) With the necessary expressions, write in detail about noise sources in the photodetector. (13)

14. (a) What is receiver sensitivity? Derive the expression for receiver sensitivity with shot and thermal noise included. (13)

Or

(b) Discuss about the lensing schemes used to improve optical source-to-fiber coupling efficiency. (13)

15. (a) Define Wavelength Division Multiplexing (WDM). Explain the operating principle and standards of WDM. (13)

Or

(b) Draw the concept of simple and modular expandable passive OADM and explain them. (13)

PART C — (1 × 15 = 15 marks)

16. (a) Explain about various design techniques for dispersion optimization of single mode fibers (SMF). (15)

Or

(b) Derive the total system rise time for determining the dispersion limitation of an optical fiber link. (15)

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