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Question Paper Code : 50559

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

Fifth/Sixth Semester

Electronics and Communication Engineering

CEC 345 — OPTICAL COMMUNICATION AND NETWORKS

(Common to : Computer and Communication Engineering/ Electronics and Telecommunication Engineering)

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are the advantages of single mode fiber over multimode fiber?
2. Compare group velocity with phase velocity.
3. What are the causes for attenuation in optical fiber? Also, recall the expression for determining attenuation.
4. What is Rayleigh scattering?
5. What is the threshold condition for LASER oscillation?
6. What is meant by population inversion?
7. Define optical return loss.
8. Outline the need for fiber attenuation measurements techniques.
9. Define optical network node and switching elements.
10. Mention the techniques used in processing the header in packet switching network.

PART B — (5 × 13 = 65 marks)

11. (a) (i) Explain the ray theory of fiber with special mention about TIR (Total Internal Reflection), acceptance angle and numerical aperture. (9)

(ii) Calculate the cutoff wavelength of a single mode fiber with core radius of 4 μm and $\Delta = 0.003$. (4)

Or

(b) (i) With neat sketch, explain the various types of optical fibers with respect to indexing. (9)

(ii) A step index fiber has an acceptance angle of 20° in the air. The fiber has a relative refractive index of 2.5%. Determine critical angle at the core cladding interface of the fiber and also find the critical propagation angle and numerical aperture. (4)

12. (a) (i) Outline the characteristics of silica glass fiber with material absorption losses. (7)

(ii) Describe how Mie scattering has impact on transmission in optical fiber than Rayleigh scattering. (6)

Or

(b) (i) A 30 km long optical fiber exhibits and rms pulse broading of 15 ns due to material dispersion alone, when the power is launched from an LED operating at 700 nm with a spectral width of 25 nm. Determine the material dispersion parameter of the fiber. (6)

(ii) Explain the importance of dispersion in a multimodal fiber. (7)

13. (a) (i) Explain the working principle of PIN photodiode and avalanche photo diode. (9)

(ii) Discuss the features of Dome LED, Surface emitter LED, Edge emitter LED. (4)

Or

(b) (i) What is meant by hetero junction. Mention its advantages. (4)

(ii) Define internal quantum efficiency of an LED. An LED has radiative and non radiative recombination times of 30 and 100 ns respectively. Determine the internal quantum efficiency. (9)

14. (a) (i) Explain the insertion loss methods of measuring attenuation in a optical fiber. (6)

(ii) Explain how intermodal dispersion measurements are carried out in frequency domain. (7)

Or

(b) Explain with neat diagram for measuring various characteristics parameters of optical fiber with a mention on measurement challenges.

15. (a) (i) Show different methods of protecting a WDM mesh network against node failure and link failure. (8)

(ii) Explain different types of Optical Network Transmission modes. (5)

Or

(b) (i) Explain the different types of Optical Switching Networks and protocols used in optical communication. (8)

(ii) Describe how optical networks are deployed to cover Local Area, Metropolitan area and Long Haul networks. (5)

PART C — (1 × 15 = 15 marks)

16. (a) (i) With suitable expression, explain the phenomenon of total internal reflection using Snell's law with figures. (9)

(ii) With necessary diagrams, distinguish step-index from graded index fibers. (6)

Or

(b) Explain the mode theory characterizing the transmission through optical fiber. Outline the significances of geometry on mode of transmission.

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