Register No.: ..... Name: .....

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

SEVENTH SEMESTER B.TECH DEGREE EXAMINATION (S), FEBRUARY 2024
ELECTRONICS AND COMMUNICATION ENGINEERING
(2020 SCHEME)

Course Code : 20ECT411

Course Name: Optical Fiber Communication

Max. Marks : 100 **Duration: 3 Hours**

PART A

(Answer all questions. Each question carries 3 marks)

1. Illustrate any six advantages of optical fiber as transmission medium in the communication.
2. Consider a multimode silica fiber that has a core refractive index n_1=1.47 and a cladding refractive index n_2=1.45. Find (a) Acceptance angle in air. (b) Numerical aperture.
3. Explain extrinsic absorption effect on the optical fiber cable.
4. Enumerate any six principal requirements of a good connector design in the optical communication system.
5. Explain the working principle of PIN photodiode as an optical detector with neat figure.
6. Enumerate advantages and disadvantages of LED compared with Laser.
7. Explain the working principle of semiconductor optical amplifier (SOA) with neat figure.
8. Illustrate the grain profiles of various optical amplifiers.
9. Describe WDM concept.
10. Explain LiFi Technology.

PART B

(Answer one full question from each module, each question carries 14 marks)

MODULE I

11. a) Show the relation of cut off wavelength and V number of step index single mode and multi-mode fiber. (7)

    b) A step index fiber in air has a numerical aperture of 0.16, a core refractive index of 1.45 and a core diameter of 60 μm. Determine the normalized frequency for the fiber, when the light at a wavelength of 0.9 μm is transmitted. Estimate the number of guided modes propagating in the fiber. (7)

OR

12. a) Compare and contrast single-mode and multimode fibers as well as step-index and graded-index fibers in terms of their design, performance and application. (7)

b) Light travelling in air strikes a glass plate at an angle $I_1 = 33^o$, where I_1 is measured between the incoming ray and glass surface. Upon striking the glass, part of the beam is reflected and part is refracted. If the refracted and refracted beams make an angle of 90^o with each other, what is the refractive index of the glass? What is the critical angle for the glass? (7)

MODULE II

13. a) Explain fiber alignment and joint loss in optical fiber communication. (6)

b) The mean optical power launched into an 8 km length of fiber is 120 µW, the mean optical power at the fiber output is 3 µW. Determine: (a) the overall signal attenuation or loss in decibels through the fiber assuming there are no connectors or splices; (b) the signal attenuation per kilometer for the fiber. (c) the overall signal attenuation for a 10 km optical link using the same fiber with splices at 1 km intervals, each giving an attenuation of 1 dB; (d) the numerical input/output power ratio in (c). (8)

OR

14. a) Describe chromatic and intermodal dispersion in optical fiber. (6)

b) Two step index fibers exhibit the parameters as given below. Estimate the critical radius of curvature at which large bending losses occur in cases mentioned below. (a) a multimode fiber with a core refractive index of 1.500, a relative refractive index difference of 3% and an operating wavelength of 0.82 µm; (b) an 8 µm core diameter single-mode fiber with a core refractive index the same as (a), a relative refractive index difference of 0.3% and an operating wavelength of 1.55 µm. (8)

MODULE III

15. a) Illustrate the working principle of a laser diode. (7)

b) Describe the working of semiconductor injection laser and comment on its efficiency. (7)

OR

16. a) Delineate the working of double-heterojunction LED with neat diagram. (6)

b) Compare the working of PIN photodiode and Avalanche photodiodes with neat sketches. (8)

MODULE IV

17. a) Describe the working of EDFA with neat sketches. (7)
    b) Explain Raman amplifier with neat sketches. (7)

OR

18. a) Explain the applications of an optical amplifier with necessary diagrams. (7)
    b) Derive the expression for the power conversion efficiency and gain of EDFA. (7)

MODULE V

19. a) Delineate optical add/drop multiplexers (OADM) with neat diagram. (7)
    b) Illustrate the importance of diffraction grating in the optical communication system with neat sketches. (7)

OR

20. a) Explain the working of OTDR with neat diagram. (7)
    b) Illustrate the concept of WDM with neat diagram. (7)

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