

- ii. Mention the advantages of fiber optic communication. 2 1 1 1
- (OR)**
- b.i. Describe the following fibre structure in detail. 8 2 1 1
- (1) Step index fiber
- (2) Graded index fiber
- ii. A graded index fiber has a core with a parabolic refractive index profile which has a diameter of $50\text{ }\mu\text{m}$. The fiber has a numerical aperture of 0.209. Estimate the total number of guided modes propagating in the fiber when it is operating at a wavelength of $0.84\text{ }\mu\text{m}$. 2 3 1 1
27. a.i. What are macro bending and micro bending losses? Explain with a suitable diagrams and expressions. 8 2 2 1
- ii. Two polarization maintaining fibers operating at a wavelength of $1.3\text{ }\mu\text{m}$ have beat length of 0.7 mm and 0.9 mm. Determine the modal birefringence in each case. 2 3 2 1
- (OR)**
- b.i. Explain in detail about the polarization mode dispersion with neat diagram. 8 2 2 1
- ii. Compare intermodal and intramodal dispersion. 2 2 2 1
28. a.i. Describe the construction and working of surface emitting LED. 8 3 3 2
- ii. Determine the total carrier recombination life time of a double hetero junction LED, where the radiative and non radiative life time of minority carriers in active regions are 30 ns and 100 ns respectively. 2 4 3 2
- (OR)**
- b.i Explain the construction and operation of Avalanche photodiode. 7 1 3 1
- ii. A GaAs PIN photodiode has the following parameters at a wavelength of 1200 nm, $ID = 4nA$, $\eta = 0.80$, $R_L = 1000\Omega$, and the surface leakage current is negligible. The incident power is 300 AW, and the receiver bandwidth is 20 MHZ. Find the quantum noise of the receiver. 3 4 3 1
29. a. With neat diagram. explain acousto optic modulator in detail. 10 2 4 1
- (OR)**
- b. Describe the amplification mechanism of Erbium dopes fiber amplifier with energy level diagram. 10 3 4 2
30. a. Explain the fabrication steps involved in PIN-HBT photo receiver. 10 3 5 1
- (OR)**
- b. Explain the following in detail. 5 3 5 1
- (i) Mach Zennder interferometer 5
- (ii) Active coupler

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Reg. No.

B.Tech. DEGREE EXAMINATION, MAY 2022
Fourth and Sixth Semester

18ECO107T – FIBER OPTICS AND OPTOELECTRONICS

(For the candidates admitted from the academic year 2018-2019 to 2019-2020)

Note:

- (i) **Part - A** should be answered in OMR sheet within first 40 minutes and OMR sheet should be handed over to hall invigilator at the end of 40th minute.
- (ii) **Part - B** should be answered in answer booklet.

Time: 2½ Hours

Max. Marks: 75

PART – A (25 × 1 = 25 Marks)

Answer **ALL** Questions

1. The refractive index of core is _____ cladding in a step index multimode optical fiber. 1 1 1 1
- (A) Smaller than (B) Greater than
- (C) Equal to (D) Proportional
2. _____ fiber having V-number is less than 2.405. 1 1 1 1
- (A) Step index (B) Plastic
- (C) Single mode (D) Multi mode
3. _____ is the critical angle where the refractive index of core and cladding are 1.48 and 1.00. 1 2 1 1
- (A) 60° (B) 42.5°
- (C) 90° (D) 65.8°
4. Meridional rays are _____ 1 1 1 1
- (A) The rays pass around the optical axis (B) The rays goes out of core
- (C) The rays are never guided by the core (D) The guided rays crossing the optical axis
5. The core RI is 1.48 and cladding RI is 1.46. What is the value of numerical aperture? 1 2 1 1
- (A) 0.354 (B) 0.455
- (C) 1.550 (D) 0.242
6. Scattering loss in glass arises from _____ variations in the material density. 1 2 2 2
- (A) Macroscopic (B) Microscopic
- (C) Refractive (D) Density
7. The amount of _____ from a bent fiber depends on the field strength at critical distance (X_c) and the distance of curvature R. 1 2 2 1
- (A) Optical radiation (B) Absorption
- (C) Dispersion (D) Optical attenuation

8. _____ dispersion occurs in single mode fiber. 1 1 1 2
 (A) Intramodal (B) Intermodal
 (C) Singal (D) Transverse
9. In a 50 km long optical fiber having an attenuation of 0.9dB/km . at 1100nm , $P_i = 400\mu\text{W}$. _____ is the output power from the fiber. 1 2 2 1
 (A) 32.44 nW (B) 12.64 nW
 (C) 54.78 nW (D) 30.89 nW
10. An optical fiber has losses of 0.6dB/km at 1300nm . If $100\mu\text{W}$ of power is launched into the fiber, how much power will reach at a distance of 20 km? 1 2 3 1
 (A) $8.6\mu\text{W}$ (B) $6.3\mu\text{W}$
 (C) $5.6\mu\text{W}$ (D) $10.3\mu\text{W}$
11. _____ confinement is used to increase the carrier recombination at the active region of LED. 1 1 3 2
 (A) Carrier (B) Optical
 (C) Electrical (D) Signal
12. _____ modes are related to the length of the cavity. 1 1 3 1
 (A) Lateral (B) Transverse
 (C) Longitudinal (D) Elliptical
13. Thermal noise is calculated by the formula 1 2 3 1
 (A) $\langle i_T^2 \rangle = \left(\frac{4K_B T}{R_L} \right) B$ (B) $\langle i_T^2 \rangle = \left(\frac{R_L}{4K_B T} \right) B$
 (C) $\langle i_T^2 \rangle = \left(\frac{2K_B T}{R_L} \right) B$ (D) $\langle i_T^2 \rangle = \left(\frac{8K_B T}{R_L} \right) B$
14. _____ is the ratio of electron-hole pairs generated to the incident photons. 1 1 3 2
 (A) Quantum efficiency (B) Power efficiency
 (C) Signal attenuation (D) Carrier efficiency
15. Avalanche multiplication factor (M) is given by 1 2 3 1
 (A) $M = \frac{IP}{IM}$ (B) $M = \frac{IM}{IP}$
 (C) $M = \left(\frac{IM}{IP} \right) RL$ (D) $M = \frac{IS}{IP}$
16. The change in refractive index of a medium due to the presence of sound wave is called 1 1 4 1
 (A) Photo emissive effect (B) Acoustic optic effect
 (C) Electro optic effect (D) Mageto optic effect

17. Kerr effect occurs when _____ 1 1 4 1
 (A) Electric field is zero (B) Magnetic field is zero
 (C) Quadratic electro optic coefficient is smaller than linear electro optic coefficient (D) Quadratic electro optic coefficient is larger than linear electro optic co-efficient
18. In circulator, an optical path of signal follows _____ 1 1 4 2
 (A) An open loop (B) An closed loop
 (C) Forward loop (D) Reverse loop
19. Fabry-Perot interferometer used for _____ 1 2 4 1
 (A) Determine the resonant modes (B) Generating electrical signal of a cavity
 (C) Determine the refractive index (D) Determine the output pulse
20. Which of the following is a magneto optic effect? 1 2 4 1
 (A) Faraday effect (B) Skin effect
 (C) Kerr effect (D) Pockel effect
21. Circuits fabricated from AlGaAs operate in wavelength region of 1 2 5 1
 (A) 0.1 and $0.2\mu\text{m}$ (B) 0.8 and $0.9\mu\text{m}$
 (C) 0.3 and $0.4\mu\text{m}$ (D) 0.6 and $0.7\mu\text{m}$
22. To minimize the OEIC chip area _____ devices are used in fabrication. 1 1 5 3
 (A) InGa (B) GaAs
 (C) InGaAs (D) InGaAsP
23. The sensitivity of a pin-HBT photo receiver is proportional to _____ 1 2 5 1
 (A) B (B) B^2
 (C) B^3 (D) B^4
24. In SLAB waveguide, the top most layer is often air and has a refractive index _____. 1 2 5 1
 (A) Lower than the other two layers (B) Higher than the other two layers
 (C) Sum of the two layers (D) Difference of the two layers
25. Devices operating at transmission rates greater than 40Gb/s are _____ 1 1 5 1
 (A) GaAs and InP (B) GaAs
 (C) InGa (D) In Ga As

PART – B ($5 \times 10 = 50$ Marks)
 Answer ALL Questions

Marks BL CO PO

26. a.i. Sketch the block diagram of elements of optical communication and describe the functions of each block. 8 2 1 1