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GIET UNIVERSITY, GUNUPUR – 765022
 B. Tech (Fifth Semester) Examinations, December – 2022
BPCEC5050 – Fiber Optic Communication
 (ECE)

Time: 3 hrs

Maximum: 70 Marks

Answer ALL Questions

The figures in the right hand margin indicate marks.

PART – A: (Multiple Choice Questions)**(1 x 10 = 10 Marks)****Q.1. Answer ALL questions**

[CO#] [PO#]

- a. What is the numerical aperture of the fiber if the angle of acceptance is 16 degree? [CO1] [PO1]
 (i) 0.50 (ii) 0.36
 (iii) 0.20 (iv) 0.27
- b. The absorption coefficient of semiconductor materials is strongly dependent on [CO1] [PO1]

 (i) Wavelength (ii) Properties of material
 (iii) Amount of light (iv) Amplitude
- c. A four-port multimode fiber FBT coupler has 50 μ W optical power launched into port 1. [CO2] [PO2]
 The measured output power at ports 2,3 and 4 are 0.003, 23.0 and 24.5 μ W respectively.
 Determine the excess loss.
 (i) 0.33 dB (ii) 0.22 dB
 (iii) 0.45 dB (iv) 0.12 dB
- d. The _____ system is best developed and is used for fabricating both lasers and [CO2] [PO1]
 LEDs for the shorter wavelength region.
 (i) InP (ii) GaSb
 (iii) GaAs/GaSb (iv) GaAs/AlGa AS DH
- e. The lower energy level contains more atoms than upper level under the conditions of [CO1] [PO2]

 (i) Isothermal packaging (ii) Population inversion
 (iii) Thermal equilibrium (iv) Pumping
- f. In a single mode fiber, the losses due to lateral offset and angular misalignment are given [CO3] [PO1]
 by 0.20 dB and 0.46 dB respectively. Find the total insertion loss.
 (i) 0.66 dB (ii) 0.26 dB
 (iii) 0.38 dB (iv) 0.40 dB
- g. Stimulated Brillouin scattering is mainly a _____ [CO3] [PO1]
 (i) Forward process (ii) Backward process
 (iii) Upward process (iv) Downward process
- h. Which of these elements cannot be used to make an optical amplifier? [CO3] [PO1]
 (i) Helium (ii) neodymium
 (iii) Erbium (iv) holmium
- i. It is a passive device which allows the flow of optical signal power in only one direction [CO4] [PO1]
 and preventing reflections in the backward direction.
 (i) Optical fiber connector (ii) Fiber slice
 (iii) Optical isolator (iv) Optical coupler
- j. A photodiode should be chosen with a _____ less than photon energy. [CO2] [PO1]
 (i) Direct absorption (ii) Band gap energy
 (iii) Wavelength range (iv) Absorption coefficient

PART – B: (Short Answer Questions)**(2 x 10 = 20 Marks)**Q.2. Answer ALL questions

	[CO#]	[PO#]
a. A step index fiber has the normalized frequency of 26.6 at 1300 nm. If the core radius is 25 μm , find the numerical aperture.	CO1	PO2
b. What is Fresnel's reflection loss? How it can be reduced?	CO1	PO1
c. What is index profile parameter? Plot the graph showing variation of $n(r)$ with r for different refractive index profiles.	CO2	PO1
d. What are the wavelength used in 2G and 3G of optical communication?	CO3	PO1
e. What is population inversion?	CO1	PO1
f. What is responsivity of a photodiode?	CO3	PO1
g. What do you mean by Zero dispersion wavelength? What is its value for a SMF?	CO1	PO1
h. What is Johnson noise?	CO3	PO1
i. Write the difference between direct and indirect bandgap material.	CO3	PO1
j. A given APD has a quantum efficiency of 65% at a wavelength of 900 nm. If 0.5 W of optical power produces a multiplied photo current of 10 A, find the multiplication factor M	CO4	PO2

PART – C: (Long Answer Questions)**(10 x 4 = 40 Marks)**Answer ALL questions

	Marks	[CO#]	[PO#]
3. a. A step index single mode fiber has a core refractive index of 1.45 and $\Delta = 1\%$. If the material dispersion at 1.55 μm for this fiber is $7 \text{ ps nm}^{-1} \text{ km}^{-1}$. Design the radius of the core so that the total dispersion at this wavelength is zero.	5	CO1	PO3
b. Explain the phenomenon of total internal reflection. Hence derive the expressions of acceptance angle & NA.	5	CO1	PO3
(OR)			
c. Explain various blocks of optical communication using suitable diagram.	5	CO1	PO1
d. A light pulse consisting of rays spread over an angle will be broadened as it propagates through the fiber. Derive an expression of pulse broadening per unit length of traversal.	5	CO1	PO2
4. a. Explain Double crucible method of Fiber fabrication.	5	CO2	PO1
b. Explain various types of mechanical splicing techniques with the help of suitable diagram.	5	CO2	PO1
(OR)			
c. What is scattering loss & explain about its types?	5	CO2	PO1
d. With the help of a neat diagram explain the construction and working of a surface emitting LED.	5	CO2	PO1
5. a. A P-N diode has a quantum efficiency of 70% for photons of energy $1.52 \times 10^{-11} \text{ J}$ calculate the wavelength at which the diode is operating and the optical power required to achieve a photo current of $3 \mu\text{A}$.	5	CO3	PO1
b. Explain with suitable diagrams about optical connectors.	5	CO3	PO2
(OR)			
c. Explain the principle, construction and working of PIN photodiode.	5	CO3	PO2
d. What is Noise? List and explain various types of noises encountered in the detector of an optical communication link? Establish S/N.	5	CO3	PO2
6. a. Explain in brief about various types of optical switching techniques.	5	CO3	PO1
b. Explain the principle, construction and working of EDFA	5	CO4	PO1
(OR)			
c. Write a short note on Solar cell.	5	CO4	PO1
d. Explain the function of optical isolator and optical circulator in fiber optic communication system.	5	CO4	PO1

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