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GIET UNIVERSITY, GUNUPUR – 765022
M. Sc. (Third Semester) Examinations, December – 2022
20PHCBOE306 - Optical Fiber & Optoelectronics
(Physics)

Time: 3 hrs

Maximum: 70 Marks

(The figures in the right-hand margin indicate marks.)

PART – A**(2 x 10 = 20 Marks)**

| Q.1. Answer ALL Questions | CO# | Blooms Level |
|---|-----|--------------|
| a. A step-index fiber has an acceptance angle of 20° in air and a relative refractive index difference of 3%. Estimate critical angle at the core– cladding interface. | CO1 | K2 |
| b. Draw the basic structure of a Step-Index fiber: (a) refractive index profile and (b) ray propagation. | CO1 | K1 |
| c. Explain power flow in step index fiber. | CO1 | K2 |
| d. What is core-cladding loss in optical fibers? | CO2 | K1 |
| e. What is a fiber-optic connector? | CO3 | K1 |
| f. What are intrinsic losses in optical fiber? | CO3 | K1 |
| g. Explain about Fusion splice. | CO3 | K1 |
| h. What is principle of optical sources? | CO4 | K1 |
| i. What do you mean by Repeater? | CO4 | K1 |
| j. What is Responsivity of a photo detector? | CO4 | K1 |

PART – B**(10 x 5 = 50 Marks)**

| <u>Answer ANY FIVE questions</u> | Marks | CO# | Blooms Level |
|---|-------|------|--------------|
| 2. Discuss the transmission of light through cylindrical wave guide by using electromagnetic theory. | 10 | CO1 | K2 |
| 3.a. Write short notes on: V – number | 5 | CO 1 | K1 |
| b. Write short notes on Fiber Bragg Grating | 5 | CO1 | K1 |
| 4. a. Explain modal dispersion in single mode fibers. | 5 | CO2 | K1 |
| b. Discuss the design of optimization of single mode fibers. | 5 | CO2 | K2 |
| 5.a. Define a Connector. What are different types of connectors? | 6 | CO3 | K1 |
| b. Two compatible multimode SI fibers are jointed with a lateral offset of 10% of the core radius. The refractive index of the core of each fiber is 1.50. Estimate the insertion loss at the joint when (a) there is small air gap and (b) an index matching fluid is inserted between the fiber ends. | 4 | CO3 | K2 |
| 6. a. What is splicing? Discuss about mechanical splices. | 6 | CO3 | K1 |
| b. A 80/125 mm graded-index (GI) fiber with a NA of 0.25 and a of 2.0 is jointed with a 60/125 mm GI fiber with an NA of 0.21 and a of 1.9. The fiber axes are perfectly aligned and there is no air gap. Calculate the insertion loss at a joint for the signal transmission in the forward and backward directions. | 4 | CO3 | K2 |
| 7.a. Discuss a p-n photodiode. | 4 | CO4 | K1 |

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|-------|---|---|-----|----|
| b. | A p-n photodiode has a quantum efficiency of 70% for photons of energy 1.52×10^{-19} J. Calculate (i) the wavelength at which the diode is operating and (ii) the optical power required to achieve a photocurrent of 3 mA when the wavelength of incident photons is that calculated in part (i). | 6 | CO4 | K2 |
| 8. a. | What is an optical amplifier? | 2 | CO4 | K1 |
| b. | Describe the principle and working of semiconductor optical amplifier (SOA) with a neat diagram. | 8 | CO4 | K2 |

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