Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI (NEW) EXAMINATION – SUMMER 2024

Subject Code:3161005 Date:17-05-2024

Subject Name:Fiber Optic Communication

Time:10:30 AM TO 01:00 PM Total Marks:70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

Q.1	**(a)**	Explain the three transmission windows of Optical fiber communication with diagram.	**03**
	(b)	Define the following. (Draw necessary figures and write equations if any) i) Acceptance angle and acceptance cone ii) Total internal reflection	**04**
	(c)	Discuss the ray optics representation for the skew rays and meridional rays in a step index fiber with neat and clean diagram. Derive an expression for numerical aperture and maximum acceptance angle in case of a step index optical fiber in terms of refractive indices of core and cladding material.	**07**
Q.2	**(a)**	Give comparison of intermodal and intramodal dispersion.	**03**
	(b)	A silica optical fiber with a core diameter large enough to be considered by ray theory analysis has a core refractive index of 1.48 and a cladding refractive index of 1.46. Determine: (i) The critical angle at the core cladding interface. (ii)The N.A. for the fiber (iii) The acceptance angle in air for the fiber.	**04**
	(c)	Discuss fiber fabrication technique along with the schematic of a fiber drawing apparatus. Explain Outside Vapour-Phase Oxidation technique for the production of optical fiber.	**07**
		OR	
	(c)	Compare Multimode fiber with single mode fiber. A multimode step index fiber with a core diameter of 70μm and a relative index difference of 1.5% is operating at a wavelength of 0.9 μm. If the core refractive index is 1.5, Calculate the normalized frequency for the fiber and the number of guided modes. Also compute the power in the clad if the total input power is 500 mw.	**07**
Q.3	**(a)**	Mention the advantages of fiber optic cable over conventional cable.	**03**

	(b)	A continuous 15 km long optical fiber link has a loss of 1.7 dB/km. i) What is the minimum optical power level that must be launched into the fiber to maintain as optical power level of 0.3 μW at the receiving end. ii) What is the required input power if the fiber has a loss of 2.7 dB/km.	**04**
	(c)	Draw the optical power loss model diagram for a point-to-point link and explain the concept of link power budget.	**07**

OR

Q.3	**(a)**	What do you mean by dispersion?	**03**
	(b)	Mention the applications of Optical amplifier.	**04**
	(c)	With a schematic diagram explain the working of optical receiver.	**07**
Q.4	**(a)**	Define the quantum efficiency & responsivity of a photo detector.	**03**
	(b)	Make a comparison of LED and LASER diode as a light source in fiber optic communication.	**04**
	(c)	Discuss different types of Attenuation Losses related to optical fiber communication in detail.	**07**

OR

Q.4	**(a)**	Explain the working principle of star coupler.	**03**
	(b)	Explain the features of Wavelength Division Multiplexing.	**04**
	(c)	Explain the operation of Avalanche Photo Diode with neat and clean diagram.	**07**
Q.5	**(a)**	Technically explain the term Spontaneous emission and Stimulated emission.	**03**
	(b)	Explain about the surface emitter LED with neat diagram.	**04**
	(c)	Explain Optical Time Domain Reflectometry (OTDR) method with its benefits over other techniques.	**07**

OR

Q.5	**(a)**	Differentiate direct bandgap materials and indirect bandgap materials.	**03**
	(b)	What do you mean by splicing? Explain any one splicing technique with diagram.	**04**
	(c)	Classify the optical fiber according to refractive index profile and materials used to make optical fiber and explain both of them in detail.	**07**

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