Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER– VI EXAMINATION – SUMMER 2026

Subject Code:3161005 Date:22-05-2026

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.**

			MARKS
Q.1	**(a)**	If we keep reducing the difference in index of refraction between core and cladding, what effect will it have on (i)Numerical aperture? (ii) Bandwidth?	**03**
	(b)	State the units of dispersion measurement in context of optical fibers. What are factors that contributes to dispersion in optical fibers?	**04**
	(c)	Derive the condition for a wave to propagate in the dielectric slab waveguide.	**07**
Q.2	**(a)**	Explain the scattering losses in optical fibers in brief.	**03**
	(b)	Define the term mode filed diameter and explain its significance.	**04**
	(c)	Derive an expression for pulse broadening due to intermodal dispersion in a multimode step index fiber.	**07**
		OR	
	(c)	Derive an expression for Numerical aperture and angel of acceptance for an optical fiber.	**07**
Q.3	**(a)**	List the dispersions that exist in single mode fibers.	**03**
	(b)	Discuss the significance of dispersion-compensated fibers.	**04**
	(c)	An 850 nm, graded index, multimode 50 Mbps fiber optic system with 1dB/km loss is used for a network. The source delivers -16 dBm power with 50 nm spectral width and the detector has a sensitivity of -48 dB at 50 Mbps. The bandwidth-distance product of the fiber is 500 Mbps-km. Determine the number of taps, each with a 0.5 dB loss that can be inserted per kilometer without affecting the distance. Also, find the maximum distance that can be covered, without any tap, if the data rate is reduced to 10 Mbps.	**07**
		OR	
Q.3	**(a)**	Compare LED vs. LASER light sources.	**03**
	(b)	Explain the working of Avalanche photodiode.	**04**
	(c)	A 6 km long fiber optic communication link has following parameters: Combined optical source + drive circuitry rise time=15ns Spectral width of the source = 40 nm Receiver front-end bandwidth = 25MHz Fiber bandwidth-distance product = 400 MHz-km Fiber material dispersion=0.0875 ns/nm.km Use your expertise as optical engineer to investigate the suitability of this link to transmit a data rate of 50 Mbps (NRZ). Assume q=0.7.	**07**

Q.4	**(a)**	Explain the three key transition processes involved in laser action.	**03**
	(b)	Explain the lensing schemes for coupling improvements.	**04**
	(c)	State the principal requirements of a good connector design. Also, explain the connector types.	**07**

OR

Q.4	**(a)**	State the mechanisms that governs the absorption in optical fibers.	**03**
	(b)	Briefly explain the fiber splicing techniques.	**04**
	(c)	State the all techniques used for fiber fabrication and explain any one of them with neat sketch.	**07**

Q.5	**(a)**	Explain the link power budget considerations.	**03**
	(b)	Explain the set up for Polarization mode dispersion measurement with block diagram.	**04**
	(c)	Two fibers with identical NA and core/cladding dimensions are connected. The refractive index of the core is 1.5. There is a small gap between the two fiber end faces. Determine the loss due to mismatch of refractive indices because of intervention of air in between fiber end faces.	**07**

OR

Q.5	**(a)**	Explain the rise time budget considerations.	**03**
	(b)	Describe the insertion-loss method for attenuation measurements in fibers.	**04**
	(c)	Consider the case of the determination of a crack in a single mode fiber whose core refractive index is 1.425. Assume that the OTDR emits wavelength to excite only a single mode. Determine the error in crack location if n_{eff}=1.42 is used. The round trip delay found is τ=200 μs.	**07**

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