Reg. No.:

Name :

VIT

Vellore Institute of Technology

(Deemed to be University under section 3 of UGC Act, 1956)

Continuous Assessment Test I

Programme	: B.Tech	Semester	:	Winter 2023-24
Course	: Optical Fiber Communications	Code	:	BECE308L
		Class Nbr	:	CH2023240500862 CH2023240500856 CH2023240502609 CH2023240502611 CH2023240502607
Faculty	: Dr.Sivasubramanian A Dr.Brintha Therese A Dr. Sangeetha RG Dr.Ilavarasan T Dr.Selvendran S	Slot	:	C1
Time	: 90 Minutes	Max. Marks	:	50

Answer ALL the questions

Q.No.	Sub. Sec.	Questions	Marks
1.	(i)	Light travels from a medium with n = 1.25 into a medium with n = 1.34, at an angle of 27° from the normal to the interface of the two media. (a) Will the speed of the light increase, decrease, or remain the same? (b) Will the wavelength of the light increase, decrease, or remain the same? (c) Will the light bend toward the normal, away from the normal, or not at all?	[3]
	(ii)	Derive the expressions for numerical aperture and acceptance angle of a fiber using the ray theory approach.	[7]
2.	(i)	A manufacturer wishes to make a silica-core step index fiber with V=75 and a numerical aperture NA=0.30 to be used at 820nm. If n_1=1.458, what should the core size and cladding index be?	[5]
	(ii)	When the mean optical power launched into a 8 km length of fiber is 120 μW, the mean optical power at the fiber output is 3 μW. Determine a.) the overall signal attenuation in decibels through the fiber assuming there are no connectors or splicers. b.) the signal attenuation per kilometre for the fiber. c.) the overall signal attenuation for a 10 km optical link using the same fiber with splices at 1 km intervals, each having an attenuation of 1 dB.	[5]
3.	(i)	Calculate the rms pulse broadening per kilometer for the following two fibers: (a). a multimode step index fiber with core index n_1 = 1.47 and Δ = 1.0 %. (b). a graded index fiber having an optimum parabolic index profile and the same n_1 and Δ as in (a),	[5]

	(ii)	The transmitted pulse in an optical system is dispersed due to various effects. Do you think that it affects the information carrying capacity of a fiber? Justify your answer with proper analytical solutions.	[5]
4.		Derive the mathematical equation for material dispersion in optical fiber and explain about the zero dispersion wavelength.	[10]
5.	(i)	Consider an optical link consisting of a 6 km long step index fiber with core index $n_1 = 1.48$ and relative index difference $\Delta = 1\ \%$. a.) If the fiber is coupled to an LED operating at 1550 nm having a 70 nm spectral width, calculate the pulse spreading due to material dispersion ($D_{mat} = 20$ ps / nm.km) b.) Calculate the pulse spreading due to waveguide dispersion if $Vd^2(Vb)/dV^2=0.1$.	[5]
	(ii)	Distinguish between Stimulated Brillouin Scattering and Stimulated Raman Scattering.	[5]

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