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			
Course	: Optical Fiber Communications	Semester	:	Winter 2023-24
		Code	:	BECE308L
		Class Nbr	:	CH2023240500877 CH2023240502615 CH2023240502603 CH2023240502613 CH2023240502617 CH2023240502619
Faculty	: Dr.Sivasubramanian A Dr. Sangeetha RG Dr.Chitra K Dr.Ilavarasan T Dr.Balaji VR Ms.Divya J	Slot	:	C2
Time	: 90 Minutes	Max. Marks	:	50

Answer ALL the questions

Q.No.	Sub. Sec.	Questions	Marks
1.	(i)	Explain about step index and graded index fibers with index profile diagrams.	[5]
	(ii)	A step-index fiber is constructed with a core refractive index (RI) of $n_1 = 1.452$, cladding RI of $n_2 = 1.445$, and a core radius of a = 4.0 μm. (a). Whether the fiber can be in single mode operation at the operating wavelength of $\lambda = 1.55$ μm? (b). Evaluate the cutoff wavelength λ_c to be used as a single mode fiber.	[5]
2.	(i)	Distinguish between : a.) Phase and group velocity b.) Meridional and skew rays	[5]
	(ii)	A certain optical fiber has an attenuation of 0.6 db/km at 1310nm and 0.3 db/km at 1550 nm. Suppose the following two optical signals are launched simultaneously into the fiber: an optical power of 150 μW at 1310 nm and optical power of 100 μW at 1550nm. What are the power levels in μW of these two signals at (a) 8 km (b) 20 km?	[5]
3		Consider an optical fiber of 50 μm diameter, core index $n_1 = 1.5$ and cladding index $n_2 = 1.49$ for operation at $\lambda = 1.31$ μm. a.) What is the numerical aperture (NA) of this fiber? b.) How many modes does this fiber support? c.) What would be the rms pulse spread due to modal dispersion over a distance of 10 km? d.) What would be the maximum fiber diameter needed to operate within a single mode condition?	[10]

4. Derive the mathematical expression for waveguide dispersion and explain how it affects the performance of the transmission in an optical fiber?. [10]

5. A glass fiber exhibits material dispersion given by $\left|\lambda^2 (d^2 n / d\lambda^2)\right|$ of 0.025. [5]

(i) (a) Determine the material dispersion parameter at a wavelength of 0.85 μm.
(b) Estimate the pulse broadening per kilometer for a good LED source with a spectral width of 20 nm at this wavelength.

(ii) Write a short note on:
a) Four Wave Mixing (FWM)
b) Cross Phase Modulation (XPM) [5]