REG.NO.: 23BEC0305

VIT®
Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

SCHOOL OF ELECTRONICS ENGINEERING
CONTINUOUS ASSESSMENT TEST - I
FALL SEMESTER 2025-2026

SLOT: D1

Programme Name & Branch	:	B.Tech & ECE, BML
Course Code and Course Name	:	BECE318L and Optical Fiber Communications
Faculty Name(s)	:	Dr S Revathi, Dr A Jabeena, Dr Chittaranjan Nayak, Dr N Sangeetha.
Class Number(s)	:	VL2025260500855, 0856, 0858
Date of Examination	:	30/1/2026
Exam Duration	:	90 minutes

Maximum Marks: 50

General instruction(s):

- Answer All Questions
- M - Max mark; CO – Course Outcome; BL – Blooms Taxonomy Level (1 – Remember, 2 – Understand, 3 – Apply, 4 – Analyse, 5 – Evaluate, 6 – Create)
- Course Outcomes
  1. List the fundamental optical laws, structures and waveguides.
  2. Comprehend the various signal degradation in the fiber optical communication.

Q. No	Question	M	CO	BL
1.	a) A single-mode step index fiber has a core diameter of 7 μm and a core refractive index of 1.49. Estimate the shortest wavelength of light which allows single-mode operation when the relative refractive index difference for the fiber is 1%.	4	1	3
	b) A single-mode step index fiber has core and cladding refractive indices of 1.498 and 1.495 respectively. Determine the core diameter required for the fiber to permit its operation at 1.48 μm and 1.60 μm. Calculate the new fiber core diameter to enable single-mode transmission at a wavelength of 1.30 μm.	6		
2.	a) With a block schematic explain the function of the key elements of a Fiber Optic Communication System.	5	1	1
	b) Describe the features for Photonic crystal fibers.	5		
3.	A single-mode GeO_2-doped silica optical fiber has a mole fraction of germanium dioxide, $x = 0.25$. a. Calculate the ultraviolet absorption loss, the infrared absorption loss and the Rayleigh scattering loss for wavelengths $\lambda = 0.8$ μm, 1.32 μm and 1.55 μm. **(9 marks)** b. Analyse the results and determine the dominant attenuation mechanism at each wavelength. **(1 marks)** Note: For Rayleigh scattering, the reference attenuation constant is $\alpha_0 = 1.2$ dB/km at a reference wavelength of $\lambda_0 = 0.85\ \mu m$.	10	2	3
4.	(a) Consider an optical source with a 40-MHz linewidth. Using the value $\Delta vB = 20$ MHz at 1550 nm, *Aeff* = 50 x 10^{-12} m^2, *Leff* = 20 km, and assuming a value of $b = 2$ (*gB* is the *Brillouin gain coefficient*, 4x 10^{-11} m/W, what is the threshold power?	5	2	3

VIT

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

REG.NO.:

SCHOOL OF ELECTRONICS ENGINEERING
CONTINUOUS ASSESSMENT TEST - I
FALL SEMESTER 2025-2026

SLOT: D1

	(b) What is the influence of four wave mixing in multi-channel propagation?	5		
5.	Estimate the optical loss due to Fresnel reflection at a fiber core from GaAs each of refractive indices 1.5 and 3.6 respectively. Calculate the optical power coupled into a step index fiber of 60 μm core diameter with a numerical aperture of 0.3 from a GaAs surface emitting LED with an emission diameter of 90 μm and a radiance of 50 W $sr^{-1}cm^{-2}$. Determine the overall power conversion efficiency for the LED if it is operating with a drive current of 100 mA and a forward voltage of 1.6V.Find the optical output power and 3 dB optical modulation bandwidth for the LED if the device emits 400 μW of optical power into air when modulated at a frequency of 150 MHz with the minority carrier recombination lifetime of 7 ns.	10	3	3