

BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI  
(MID SEMESTER EXAMINATION SP/2023)

CLASS: BTECH  
BRANCH: ECE

SEMESTER : VI  
SESSION : SP/2023

SUBJECT: EC355 FIBER OPTIC COMMUNICATION

TIME: 02 Hours

FULL MARKS: 25

**INSTRUCTIONS:**

1. The question paper contains 5 questions each of 5 marks and total 25 marks.
  2. Attempt all questions.
  3. The missing data, if any, may be assumed suitably.
  4. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates
- 

		CO	BL
Q.1(a)	Define: (i) Axial ray (ii) Skew ray (iii) Leaky modes (iv) Cladding mode	[2]	1 1
Q.1(b)	Draw a schematic representation of light path propagation in single-mode step-index fiber, multi-mode step-index and multi-mode graded-index fiber with their dimensions of core and cladding regions.	[3]	1 1
Q.2(a)	The speed of light in the core of a SI fiber is $2 \times 10^8 m/s$ . When the fiber is placed in the air, the critical angle at the core-cladding interface is $75^\circ$ . Calculate the numerical aperture of the fiber	[2]	1 3
Q.2(b)	Explain MCVD method for fiber Preform fabrication with diagram.	[3]	1 2
Q.3(a)	Illustrate graphically how $LP_{11}$ modes are derived from exact modes? Explain fiber Birefringence.	[2]	1 2
Q.3(b)	A multimode step index fiber with a core diameter of $80 \mu m$ and a relative index difference of 1.5% is operating at a wavelength of $0.85 \mu m$ . If the core refractive index is 1.48, calculate: (a) the normalized frequency for the fiber; (b) the number of guided modes.	[3]	1 3
Q.4(a)	Why are direct band gap materials preferred over indirect band gap materials for optical source?	[2]	2 2
Q.4(b)	Derive an expression for material dispersion in a single mode fiber. Explain how it can be minimized.	[3]	1 2
Q.5(a)	Explain absorption, spontaneous emission, stimulated emission, and population inversion involved in laser action.	[2]	2 2
Q.5(b)	Define internal quantum efficiency of an LED. Formulate an expression for the optical power generated internally to the LED.	[3]	2 1,6

.....24/02/2023:.....M