

GUJARAT TECHNOLOGICAL UNIVERSITY**ME – SEMESTER –I-(Old) EXAMINATION – SUMMER 2019****Subject Code: 2710503****Date: 14/05/2019****Subject Name: Fiber Optic Communication****Time: 02:30 PM TO 05:00 PM****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

		MARKS
Q.1	Answer the followings:	14
	1 Numerical aperture is a deciding factor for number of modes. Justify.	
	2 The optical BW of LED is greater than electrical BW. Justify.	
	3 What is the β range for a mode to be guided? What is cut off condition?	
	4 What is the condition to reach the lasing threshold?	
	5 What is the unit of polarization mode dispersion?	
	6 What is the principle of dispersion Compensating fiber?	
	7 Mention three windows used for optical communication. At which wavelength attenuation in optical fiber communication is minimum?	
Q.2	(a) What are different methods of carrier and optical confinement?	03
	(b) Why confinement is needed in LED? Draw Double hetro structure LED. Explain how carrier and optical confinement is achieved with this structure?	04
	(c) How does material dispersion occur in an optical fiber? Obtain the expression for group delay τ_{mat} resulting from material dispersion and deduce the relation for pulse spread δ_{mat} in terms of material dispersion $D_{\text{mat}}(\lambda)$.	07
OR		
	(c) Explain polarization mode dispersion and Intermodal distortion in detail.	07
Q.3	(a) Define: i) Mode Field diameter ii) Fiber beat length iii) Dispersion	03
	(b) Draw and Explain Basic principle of operation of LASER.	04
	(c) Mention the principal requirement of good optical detector. What are different types of noises affect the detector? Find Signal to Noise Ratio of optical detector.	07
OR		
Q.3	(a) Determine normalized frequency at 850 nm for a step index fiber having 30 μm radius, n_1 is 1.48, n_2 is 1.46. How many modes propagate in this fiber?	03
	(b) Compare Step Index and Graded Index Fiber.	04
	(c) What is Avalanche effect? Draw and explain working of Avlanche photo diode.	07
Q.4	(a) For $\text{Ga}_{1-x}\text{Al}_x\text{As}$ laser with $x=0.07$ find energy gap and wavelength.	03
	(b) Calculate the link power budget to construct an optical link of 15 Km and BW of 100 Mbps. Components are chosen with following characteristic: receiver sensitivity is -50dBm, Fiber loss is 2	04

dB/Km, and a transmitter launch power of 0dBm, Source and detector coupling loss is of 1dB each. It is anticipated that 10 splices are required, with each of loss of 0.4 dB. Determine whether the system operates with sufficient power margin or not.

- (c) Explain Mach Zehnder Interferometer Multiplexer in detail. **07**

OR

- Q.4 (a)** Define: i) Bending Loss ii) Scattering Loss iii) Absorption Loss **03**

- (b)** A double-hetero junction InGaAsP LED emitting at a peak wavelength of 1310 nm has radiative and non radiative recombination times of 25 and 90 ns, respectively. The drive current is 35 mA. Find the internal quantum efficiency and internal power level. If the refractive index of the light source material is 3.5, find the power emitted from the device. **04**

- (c)** Write a short note on Optical Isolator and Circulator. **07**

- Q.5 (a)** What is the Amplification mechanism in EDFA? Draw Architecture of EDFA and List efficiency and Gain of EDFA. **07**

- (b)** What are the non-linear effects on network performance? Explain stimulated Raman Scattering and Four wave mixing. **07**

OR

- Q.5 (a)** Explain different protection schemes in SONET/SDH. **07**

- (b)** Explain The Cutback Technique and Insertion loss Method for Attenuation measurement. **07**
