Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI (OLD) - EXAMINATION – SUMMER 2017

Subject Code: 161005 **Date: 01/05/2017**

Subject Name: Optical Communication

Time: 10:30 AM to 01:00 PM **Total Marks: 70**

Instructions:

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

Q.1 **(a)** Explain the fiber fabrication technique along with the schematic of a fiber drawing apparatus. Also explain the outside vapor phase oxidation technique for fiber fabrication. **07**

(b) A multimode fiber that has a core refractive index of 1.480 and a core cladding index difference 2%. Find the (i) Numerical Aperture (ii) the acceptance angle (iii) the critical angle. **03**

(c) Define the quantum efficiency related to photo detector. In a 100 ns pulse, $6X10^6$ photons at a wavelength of 1300 nm fall on an InGaAs photodetector and on the average, $5.4 X 10^6$ electron-hole pairs are generated. Find out the quantum efficiency **04**

Q.2 **(a)** When the mean optical power launched into an 8 km length of fiber is 120μW, the mean optical power at the fiber output is 3 μW. Determine **07**

(i) The overall signal attenuation in decibels through the fiber assuming there are no connectors or splices.

(ii) The signal attenuation per kilometer for the fiber

(iii) The overall signal attenuation for a 10 km optical link using the same fiber with splices at 1 km intervals each giving an attenuation of 1 dB.

(iv) The numerical input/output ratio in (iii).

(b) What is dispersion in optical fiber? Classify different dispersion with reasons. Explain its effect in optical communication. How to reduce the effect of dispersion? **07**

OR

(b) Using simple ray theory, describe the mechanism for the transmission of light within an optical fiber and show how acceptance angle is related to the fiber numerical aperture. **07**

Q.3 **(a)** A photo diode has a quantum efficiency of 65% when photons of energy 1.5×10^{-19} J are incident upon it. **07**

(i) At what wavelength is the diode operating?

(ii) Calculate the incident optical power required to obtain a photo current of 2.5 μA when the photodiode is operating as described above.

(b) What is splicing? Explain different techniques of splicing. **07**

OR

Q.3 **(a)** Draw and explain the schematic of an edge-emitting double heterojunction LED. **07**

(b) The quantum efficiency of particular silicon RAPD is 80% for the detection of radiation at a wavelength of 0.9μm. When the incident optical power is 0.5μW, the output current from the device (after avalanche gain) is 11 μA. Determine the multiplication factor of the photodiode under these conditions. **07**

Q.4 **(a)** Explain the principal requirements of a good connector in detail. Which **07**

alignment schemes are used in the fiber optic connectors?

	(b)	List the factors that decide the performance of optical reception and explain it. Also draw and explain eye diagram in detail.	**07**

OR

Q.4	**(a)**	Derive the equation of power coupling from LED source to step index fiber: (1) when source radius is less than fiber radius (2) when source radius is greater than the fiber radius.	**07**
	(b)	Explain the principle of operation of (i) EDFA (ii) Raman Amplifier.	**07**
Q.5	**(a)**	With necessary diagrams explain the operation of p-n photo diode in detail.	**07**
	(b)	Write short notes on Syncronous optical fiber networks(SONET)	**07**

OR

Q.5	**(a)**	Write a brief note on Optical Couplers.	**07**
	(b)	Explain Optical Time Domain Reflectometry (OTDR) method with its benefits over other techniques.	**07**

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