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

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI (NEW) - EXAMINATION – SUMMER 2018

Subject Code:2161005 **Date:08/05/2018**

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 basic principal of Optical Fiber. Compare Optical Fiber with Co-axial cable as a communication channel.	**03**
	(b)	What is normalized frequency? A step index fiber in air has a numerical aperture of 0.16, core refractive index 1.45, and core diameter 60 micro meter. Assume that wavelength is 0.1 micrometer. Determine normalized frequency for fiber.	**04**
	(c)	Define and explain following terms: 1) Critical Angle 2) Numerical Aperture 3) Meridional Ray 4) Dark Current 5) Bending Losses 6) Response Time 7) Monochromatic Source	**07**
Q.2	**(a)**	Discuss linear scattering losses in optical fiber with respect to, (1) Rayleigh Scattering (2) Mie Scattering	**03**
	(b)	Explain the importance of cladding in optical fiber communication. Justify the statement: "Light travels faster in cladding than core."	**04**
	(c)	What is dispersion? Discuss various types of dispersions and their effect on performance of optical fiber. Derive the equation for intermodal dispersion.	**07**
		OR	
	(c)	Discuss in detail, different types of Attenuation Losses related to optical fiber communication.	**07**
Q.3	**(a)**	What is graded index fiber? How it is superior to step index fiber?	**03**
	(b)	Calculate the rms pulse broadening per km due to intermodal dispersion for the multimode step index fiber of 6 km optical link with the 86.7 ns rms pulse broadening for an optimum near parabolic profile graded index fiber with the 1.5 core axis refractive index and 1% relative refractive index difference.	**04**
	(c)	List the important parameters of photo detectors. Briefly explain the principal of optical detection. Discuss the major advantages of APD over P-i-n photodiode.	**07**
		OR	

Q.3	**(a)**	Technically explain the term spontaneous emission and stimulated emission.	**03**
	(b)	A p-n photodiode has a quantum efficiency of 50% at a wavelength of 0.9 micro meter. Calculate: (1) Its responsivity at 0.9 micrometer. (2) The received optical power if the mean photocurrent is 10^{-6} A.	**04**
	(c)	Define quantum efficiency. Derive an expression for responsivity and prove that responsivity is directly proportional to the quantum efficiency at a particular wavelength.	**07**
Q.4	**(a)**	Explain population inversion.	**03**
	(b)	Define and explain following with reference to LASER. (1) Mode Hoping (2) Frequency Chirp	**04**
	(c)	Describe the working principal and functioning of Raman amplifier with neat diagram.	**07**
		OR	
Q.4	**(a)**	Define and explain internal quantum efficiency and differential quantum efficiency of a LASER.	**03**
	(b)	Compare LASER and LED as an optical Source.	**04**
	(c)	Discuss and compare link power budget and rise time budget methods for design of optical link.	**07**
Q.5	**(a)**	List the major types of optical couplers and explain any one.	**03**
	(b)	Determine the power internally generated within the device when the peak emission wavelength is 0.87 micrometer at a drive current of 40 mA. The internal quantum efficiency of the device is 0.625.	**04**
	(c)	What is splicing? Explain various fiber splicing techniques in detail.	**07**
		OR	
Q.5	**(a)**	Explain the basic principles of WDM and DWDM with respect to optical fiber system.	**03**
	(b)	What is the use/application of OADM, optical circulators, wavelength converter and OTDR in optical communication?	**04**
	(c)	Write a technical note on optical receivers.	**07**

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