Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC - SEMESTER – V • EXAMINATION – WINTER 2012

Subject code: X 51102 **Date: 17/01/2013**

Subject Name: Optical Communication

Time: 02.30 pm - 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.**

Q.1 **(a)** Draw the block diagram for optical communication link. Discuss the attractive features of the optical communication. **07**

(b) Explain the snell's law for TIR. Derive the expression of numerical aperture for step index fiber. **07**

Q.2 **(a)** Solve the followings. **07**

i) A silica optical fiber with a core diameter large enough to be ray theory analysis has a core refractive index of 1.50 and a cladding refractive index of 1.47. Determine

a) Critical angle at core cladding interface.

b) Numerical aperture for the fiber.

c) The acceptance angle in air for the fiber.

ii) A multimode step index fiber with a core diameter of 80 µm and relative index difference of 1.5% is operating at a wavelength of 0.85 µm. If core refractive index is 1.48 estimate a) normalized frequency for the fiber b) number of guided modes supported by the fiber.

(b) Compare graded index fiber & step index fiber. **07**

OR

(b) Enlist the fiber fabrication methods & explain outside vapor phase oxidation with neat sketch. **07**

Q.3 **(a)** Define the term attenuation & explain the basic attenuation mechanism in brief. **07**

(b) When the mean optical power launched in to an 8 km length fiber is 120 µW, the mean optical power at fiber output is 3 µW. **07**

Determine

a) Signal attenuation in dB per km

b) Overall signal attenuation for 10 km optical link using the same fiber with splices at 1 km intervals, each giving attenuation of 1 dB.

c) Numerical input/output power ratio in b)

OR

Q.3 **(a)** Explain in brief synchronous optical network. **07**

(b) Classify the optical amplifier, and discuss semiconductor optical amplifier. **07**

Q.4 **(a)** Draw with neat & clean sketch edge emitting double hetrojunction LED & explain the same. **07**

	(b)	Determine the emission wavelength for given light source material a) $Ga_{1-x}Al_xAs$, x = 0.07 b) $In_{0.74}Ga_{0.26}As_{0.57}P_{0.43}$	**07**
		OR	
Q.4	**(a)**	Define two important characteristics of photodetector, and Describe the working of RAPD with neat sketch.	**07**
Q.4	**(b)**	Solve the followings.	**07**
	i)	A double heterojunction InGaAsP LED emitting at a peak wavelength of 1310 nm has radiative & nonradiative recombination times of 30 ns and 100 ns, respectively. Determine the internal quantum efficiency & optical power generated internally for 40 mA drive current.	
	ii)	When 3×10^{11} photons each with a wavelength of 0.85 µm are incident on a photodiode, on average 1.2×10^{11} electrons are collected at the terminals of the device. Determine the quantum efficiency & the responsivity of the photodiode at 0.85 µm.	
Q.5	**(a)**	Explain the operational principles of WDM & describe the 2 × 2 fiber coupler.	**07**
	(b)	Explain optical time domain reflectometer and describe the OTDR trace.	**07**
		OR	
Q.5	**(a)**	Explain the point to point link in detail & discuss the optical power loss model.	**07**
	(b)	Describe the insertion loss method for optical attenuation measurement.	**07**

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