Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC - SEMESTER–V • EXAMINATION – WINTER 2013

Subject Code: X 51102 **Date: 06-12-2013**

Subject Name: Optical Communication

Time: 10.30 AM - 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 major elements of the optical transmission link, and list the advantages of optical fiber communication. **07**

(b) Solve the followings. **07**

i) Given the speed of light in the following types of glass, calculate the index of refraction for each one.

Barium Flint: 1.89×10^8 m/s

Spectacle Crown: 1.97×10^8 m/s

Fused Quartz: 2.06×10^8 m/s

ii) A graded index fiber with a parabolic refractive index profile core has a refraction index at the core axis of 1.5 and refractive index difference of 1%. Estimate the maximum possible core diameter which allows single mode operation at a wavelength of 1.3 μm.

Q.2 **(a)** List attenuation mechanisms in fiber optics & discuss any one in brief. **07**

(b) Derive the equation of power coupling from LED source to step index fiber when source radius is less than fiber radius & when source radius is greater than fiber radius. **07**

OR

(b) Discuss briefly the Fabry perot resonator cavity with neat sketch & explain how it works as a laser. **07**

Q.3 **(a)** Explain fusion splicing, V grove splicing & elastic tube techniques for fiber splicing. **07**

(b) Write a short note on possible lensing schemes used to improve optical source to fiber coupling efficiency. **07**

OR

Q.3 **(a)** Explain following with respect to laser diodes: **07**

i) The structure with neat & labeled sketch.

ii) Modes of the cavity.

iii) Threshold conditions for lasing.

(b) List the advantages of LED. For a DH surface emitter LED which has an emission area diameter of 50 μm is butt jointed to an 80 μm core step index fiber with a numerical aperture of 0.15. The device has a radiance 30 W sr^{-1} cm^{-2} at a constant operating drive current. Estimate the optical power coupled into fiber if it is assumed that the Fresnel reflection coefficient at the index matched fiber surface is 0.01. **07**

Q.4 **(a)** Explain the operation of fundamental optical receiver with neat sketch. **07**

(b) Mention the advantages of LASER. A Laser diode has a lateral Ø=0˚ and transverse Ø=90˚ half power beam widths of 2θ= 60˚ & 30˚ respectively, what are the transverse & lateral power distribution coefficient for this device? **07**

OR

Q.4	**(a)**	Explain Mach-Zehnder Interferometer (MZI) multiplexer in detail.	**07**
	(b)	Define the performance parameters of 2 × 2 fiber coupler. For a 2 × 2 biconical tapered fiber coupler has an input power P_0=200 μW, output power at the other three ports are P_1=90 μW, P_2=85 μW, P_3=6.3 nW, calculate coupling ratio, excess loss and return loss.	**07**
Q.5	**(a)**	Describe the insertion loss method for optical attenuation measurement.	**07**
	(b)	Explain eye pattern with neat sketch along with key performance parameters.	**07**

OR

Q.5	**(a)**	Describe key system requirements needed for analyzing point to point link; discuss the component selection for the same based on the charactristics of the components.	**07**
	(b)	Write detail note on SONET.	**07**

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