



(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 121955

Roll No.

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B. Tech.

(SEM. VII) (ODD SEM.) THEORY
EXAMINATION, 2014-15

OPTICAL FIBER COMMUNICATION

Time : 3 Hours]

[Total Marks : 100

1 Attempt any **FOUR** parts : **5x4=20**

- (a) What is meant by optical waveguide structure?
- (b) Explain briefly about bending losses.
- (c) Compare direct and indirect band gap semiconductors.
- (d) Describe about Avalanche photo diode.
- (e) List the advantages of photo diodes over other photo detectors.
- (f) Derive the expression for system rise time.

- 2 Attempt any **TWO** parts : **10x2=20**
- (a) Define absorption, spontaneous emission and stimulated emission and derive the Einstein relations for the same.
 - (b) Write notes on:
 - (i) pulse broadening
 - (ii) modal birefringence
 - (c) What is population inversion? Sketch neatly and explain about double hetero structure LED.

- 3 Attempt any **TWO** parts : **10x2=20**
- (a) Explain in detail about nonlinear scattering effects? Compare the threshold power of SRS and SBS.
 - (b) List out the various components of optical communication systems. Discuss the optical transmitter circuits.
 - (c) When the mean optical power launched into an 8km length of fiber is $120\mu\text{W}$, the mean optical power at the fiber output is $3\mu\text{W}$.

Determine:

- (a) The overall signal attenuation (or) loss in decibels through the fiber assuming there are no connector (or) splices.
- (b) The signal attenuation per kilometer for fiber.
- (c) The overall signal attenuation for a 10km optical link using the same fiber with splices at 1km intervals each giving an attenuation of 1dB.
- (d) the numerical Input/Output ratio in (c).

4 Attempt any **TWO** parts : **10x2=20**

(a) Silica has an estimated fictive temperature of 1400°K with an isothermal compressibility of $7 \times 10^{-11} \text{ m}^2 \text{ N}^{-1}$. The refractive index and the photo-elastic co-efficient for silica are 1.46 and 0.286 respectively. Determine the theoretical attenuation in decibels per km due to fundamental Rayleigh scattering in silica at optical wavelengths of 0.63, 1.00 and 1.3 μm .

$$(K = 1.381 \times 10^{-23} \text{ JK}^{-1})$$

(b) What are the channel losses? Obtain the expression for signal to noise ratio for digital and analog optical link.

(c) Write short notes on following:

- (i) pre amplifier
- (ii) automatic gain control and
- (iii) equalization in optical receivers.

5 Attempt any **TWO** parts : **10x2=20**

(a) Define the following with relevant equations (i) acceptance angle (ii) critical angle (iii) numerical aperture.

(b) Discuss subcarrier intensity modulation using amplitude and frequency modulation.

(c) Design and explain drive circuits for LED and LASER.