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B.Tech. (Sem. - 7th/8th)

OPTICAL FIBER COMMUNICATION

SUBJECT CODE : EC - 404

Paper ID : [A0329]

[Note : Please fill subject code and paper ID on OMR]

Time : 03 Hours

Maximum Marks : 60

Instruction to Candidates:

- 1) Section - A is **Compulsory**.
- 2) Attempt any **Four** questions from Section - B.
- 3) Attempt any **Two** questions from Section - C.

Section - A

Q1)

(10 × 2 = 20)

- a) What is total internal reflection and explain its importance for optical communication.
- b) What is the carrier frequency for an optical communication system operating at 1.55 μm .
- c) What is group velocity dispersion?
- d) List all the basic components of a fiber optic cable & explain their functions.
- e) Why indirect band gap material is used for manufacturing LED's?
- f) How does spontaneous & stimulated emission occur?
- g) What is the responsivity of a photodiode if its quantum efficiency is 90%.
- h) What is frequency chirp?
- i) What is the role of system margin in link power budget?
- j) List the advantages of using code division multiplexing.

Section - B

(4 × 5 = 20)

- Q2)** Why we need optical fiber cables? Explain various types of fiber optic cables used in the industry.
- Q3)** A 6 km optical link consists of multimode step index fiber with a core refractive index of 1.5 and a relative refractive index difference of 1%. Estimate the delay difference between the slowest and fastest mode at fiber output and rms pulse broadening due to inter-modal dispersion on the link.
- Q4)** What are the differences between TE, TM and HE modes?
- Q5)** What is responsivity and how it depends on the wavelength of a photodiode?
- Q6)** What is WDM and list the reasons for its development as a major communication technology?

Section - C

(2 × 10 = 20)

- Q7)** Find out E and H component of a cylindrical single mode fiber using Maxwell equations.
- Q8)** A 1550 nm SM digital fiber optical link needs to operate at 565 Mb/s over 50 km without repeaters. A single mode InGaAsp LD launches an average power of -13 dBm into the fiber. The fiber has a loss of 0.35 dB/km & there is splice with a loss of 0.1 dB every km. The coupling loss at the receiver is 0.5 dB and receiver uses InGaAs APD with sensitivity of -39 dBm, excess noise penalties are predicted to be 1.5 dB. Set up the power budget link and the system margins.
- Q9)** What is Noise? List and explain various types of noises encountered in an optical communication link?

