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Total No. of Questions : 09] [Total No. of Pages : 02

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

OPTICAL FIBER COMMUNICATIONS

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) Why do we prefer optical fiber communication for long distance transmission?

b) Calculate the transmission distance over which the optical power will attenuate by a factor of 10 for the fiber with loss of 0.2 dB/km. Assume the typical relation of fiber attenuate on loss.

c) Define single mode fiber. What is the significance of cut off wavelength concern with it?

d) How and why do stimulated scattering effects occur in optical fibers?

e) Where do you use distributed feedback laser (DFB) structures?

f) What do you understand by Single Longitudinal Mode (SLM) laser?

g) Define the quantum efficiency and the responsivity of a photodiode.

h) Dry fibers have acceptable losses over a spectral region extending from 1.3 to 1.6 μm. Estimate the capacity of a WDM system covering this entire region using 40 Gb/s channels spaced apart by 50 GHz.

i) Explain briefly frequency chirping in optical communication.

j) List the four desirable properties of a tunable optical filter.

Section - B

(4 × 5 = 20)

Q2) Explain the following terms:

(a) Fiber birefringence

(b) Spot Size

(c) Confinement factor.

Q3) Give importance, applications of double hetero junction and direct band semiconductors.

Q4) Write a short note on LASER structures and their characteristics.

Q5) Given that the following measurements were taken for an APD, calculate the multiplication factor for the device. Received optical power = 1.35 μW, Corresponding output photocurrent (After Avalanche gain) = 4.9 μA, Quantum efficiency at 1.35 μm = 40%.

Q6) Describe shot, thermal noise mechanisms in optical receivers.

Section - C

(2 × 10 = 20)

Q7) What are causes of optical power loss and nonlinear phase modulation through optical fibers? Give detailed picture of them.

Q8) A 1.3 μm long haul light wave system is designed to operate at 1.5 Gb/s. It is capable of coupling 1 mW of average power into the fiber. The 0.5 dB/km fiber cable loss includes splice losses. The connectors at each end have 1 dB losses. The InGaAs p-i-n receiver has a sensitivity of 250 nW. Make the power budget and estimate the repeater spacing.

Q9) What are system performances issues in the design of WDM lightwave systems? Explain in detail each of them.