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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) Which is the most commonly used wavelength of light used for optical communication? Briefly explain why.

b) Sketch the variation of optical power with time for a digital NRZ bit stream '010111101110' by assuming a bit rate of 2 Gb/s. Calculate the duration of the shortest and widest optical pulse.

c) What are the techniques to handle polarization mode dispersion?

d) Why does splicing of fiber cause optical loss?

e) Briefly comment on the importance of extinction ratio kept for digital modulation over laser diode.

f) What are the problems in laser structures for the operation at higher wavelength region?

g) List the advantages and disadvantage of APD (Avalanche Photodiodes) based optical receivers.

h) The carrier velocity in a silicon p-i-n photodiode with 25 μm depletion layer width is 3×10^4 m/s. Determine the maximum response time for the device.

i) Explain briefly modal noise in optical communication.

j) What do understand by dry fiber use for WDM?

Section - B

(4 × 5 = 20)

Q2) What are graded index fibers? How do they considerably reduce the intermodal dispersion? What is the optimum refractive index profile parameter for minimum dispersion (or maximum BL product)?

Q3) Generally, for single longitudinal mode Laser operation, control of longitudinal modes is necessary. How do we achieve it in various laser structures?

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

Q5) An APD with a multiplication factor of 20 operates at a wavelength of 1.5 μm. Calculate the quantum efficiency and photocurrent from the device if its responsivity at this wavelength is 0.6 A/W and 10^{10} photons of wavelength 1.5 μm are incident upon it per second.

Q6) Explain the design of MSM photodetectors.

Section - C

(2 × 10 = 20)

Q7) What are the causes of dispersion in single mode fibers? Discuss each of them in detail.

Q8) Make the power budget and calculate the maximum transmission distance for a 1.3 μm light wave system operating at 100 Mb/s and using an LED for launching 0.1 mW of average power into the fiber. Assume 1 dB/km fiber loss, 0.2 dB splice every 2 km, 1 dB connector loss at the each end of fiber link, and 100 nW receiver sensitivity, Allow 6 dB system margin.

Q9) What are the optical components required to implement WDM technology for optical communication systems? Explain the operational principle of each of them briefly.

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