

Roll No.

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.

