

Total No. of Questions : 8]

SEAT No. :

P780

[Total No. of Pages : 3

[5870]-1092

T.E. (Electronics Engg.)

FIBER OPTIC COMMUNICATION

(2019 Pattern) (Semester - II) (304215D) (Elective - II)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Solve question Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data, if necessary.
- 5) Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

- Q1)** a) List the advantages of optical communication systems. **Explain** the important factors responsible for power loss in optical fiber. [8]
- b) 'Optical signal distortion limits the information carrying capacity of the fiber' **Justify** the comment with an elaborate analysis. [10]

OR

- Q2)** a) State the various types of misalignment losses and losses due to mismatch of fiber parameters and bending losses.

**Solve :**

The mean optical power launched into an optical fiber link is 1.5 mW and the fiber has an attenuation of 0.5 dB km<sup>-1</sup>. **Determine** the maximum possible link length without repeaters (assuming lossless connectors) when the minimum mean optical power level required at the detector is 2 µW. [8]

- b) **Explain** by writing short notes on : [10]
- i) Dispersion shifted fiber (DSF)
  - ii) NZDSF
  - iii) Dispersion flattened and
  - iv) Polarization maintaining fiber

P.T.O.

**Q3) a) Describe** with the aid of suitable diagrams the mechanism giving the emission of light from an LED. **Discuss** the effects of this mechanism on the properties of the LED in relation to its use as an optical source for communications. [9]

b) **Compare** between the photodiodes: p-n, pi-n, APD and phototransistor. **Comment** on their usefulness from link design perspective. [8]

OR

**Q4) a) Explain** the important performance and compatibility requirements for detectors used in optical fiber communication links. [9]

b) The power generated internally within a double-hetero junction LED is 28.4 mW at a drive current of 60 mA. **Determine** the peak emission wavelength from the device when the radiative and nonradiative recombination lifetimes of the minority carriers in the active region are equal. [8]

**Q5) a) Draw** a neat labeled diagram of a WDM system. **Explain** the need of wavelength division multiplexing in fiber optic communication systems. [9]

b) **Explain** the optical components: optical isolators, circulators and fiber Bragg grating for multiplexers & De-multiplexers. [9]

OR

**Q6) a) Explain** the various loss mechanisms that arise on account of joints, splices, connectors, mismatch of parameters and fiber misalignment in a fiber optic link. [9]

b) **Compare** the SOA, EDFA and the Raman amplifiers in relation to the provision of amplification within optical fiber communication systems. [9]

**Q7) a) Draw** a neat labelled diagram to show a point to point fiber optic communication link. **Explain** the system design considerations for each of the components on the path. [9]

- b) In an experimental setup for establishing an analog optical fiber link, a student chooses the components with the 10% to 90% rise time values as indicated below:

Source (LED) : 10 ns

Detector (APD) : 3 ns

Fiber cable (intermodal) : 9 ns/km

The desired link length without repeaters is 5 km and the required optical bandwidth is 6 MHz. **Predict** whether the above selection of components gives a viable system. [8]

OR

- Q8) a)** A 1550 nm single mode digital fiber optic link needs to operate at 622 Mb/s over 80 km without amplifiers. A single mode InGaAsP laser launches an average optical of 13 dBm into the fiber. The fiber has a loss of 0.35dB/km, and there is a splice with a loss of 0.1 dB every kilometer. The coupling loss at the receiver is 0.5 dB and the receiver uses an InGaAs APD with a sensitivity of -39 dBm. Excess noise penalties are predicted to be 1.5 dB. Set up an optical power budget for this link and find the system margin. **Calculate** the system margin at 2.5 Gb/s with an APD sensitivity of -31 dBm? [9]
- b) **Explain** the various methods used for the analysis of the optical fiber links. What metrics are useful for evaluating the performance of optical fiber analog links and digital links. [8]

