

(Following Paper ID and Roll No. to be filled in your Answer Book)

**PAPER ID : 2723**

Roll No.

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### B.Tech.

(SEM. VII) ODD SEMESTER THEORY  
EXAMINATION 2012-13

### OPTICAL FIBRE COMMUNICATION

Time : 3 Hours

Total Marks : 70

Note :- (i) All questions are compulsory.

(ii) All questions carry equal marks.

1. Attempt any **four** parts of the following : (5×4=20)

(a) Draw the block diagram of optical fiber communication system.

(b) Explain the concept of phase velocity and group velocity.

(c) List out various advantages of optical fiber communication system over the conventional electrical communication system.

(d) Explain the concept of acceptance angle in optical fiber with the help of proper diagram. How it is related to the numerical aperture of optical fiber ?

(e) What are skew rays in the optical waveguide ? Explain their propagation with the help of ray diagram.

(f) What do you understand by the term 'mode' in optical waveguide ? Sketch the various modes in a planar waveguide.

Attempt any two parts of the following :

(2=20)

- (a) 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 :
- (i) the delay difference between the slowest and fastest modes at the fiber output.
  - (ii) the rms pulse broadening due to intermodal dispersion on the link.
  - (iii) the maximum bit rate that may be obtained without substantial errors on the link assuming only intermodal dispersion.
- (b) Describe, with the aid of sketches, the techniques that can be employed to produce both high and low birefringence PM fibers. A two polarization mode PM fiber has a mode coupling parameter of  $2.3 \times 10^{-5} \text{ m}^{-1}$  when operating at a wavelength of  $1.55 \mu\text{m}$ . Estimate the polarization crosstalk for the fiber at this wavelength.
- (c) Describe the techniques employed and the fiber structures utilized to provide :
- (i) Dispersion shifted single mode fibers
  - (ii) Dispersion flattened single mode fibers.

*Handwritten notes:*  
2  
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Attempt any two parts of the following :

(10×2=20)

- (a) Explain the working principle of LED. How the quantum efficiency of a LED is defined ? Why hetero-junction structure is preferred over the homo-junction structure in LEDs ?

*Q. 3b Similar*

(b) Explain the principle, construction and working of semiconductor injection laser diode. Explain the phenomenon of Mode hopping and frequency chirping in the injection laser.

(c) Define the quantum efficiency and responsivity of a photo-detector. Derive an expression for the responsivity of an intrinsic photo-detector in terms of the quantum efficiency of the device and the wavelength of the incident radiation.

4. Attempt any four parts of the following : (5×4=20)

- (a) Briefly discuss the possible sources of noise in optical fiber receivers. Describe the quantum noise in detail.
- (b) Sketch the full equivalent circuit for a digital optical fiber receiver. Briefly explain its various parts.
- (c) Explain the working of APD receiver.
- (d) Draw the block schematic of the front end of an optical receiver.
- (e) Discuss the major considerations in the design of digital drive circuit for a LED source.
- (f) Discuss the advantages of any one of the pulse analogue technique for optical fiber transmission.

(4)

5. Write short notes on any two of the following : (10×2=20)

- (a) Coherent Optical fiber System.
- (b) Channel Losses.
- (c) Power budgeting in optical systems.

(5)