[Total No. of Questions - 9] [Total No. of Pr d Pages - 4]
(2066)

16121(J) June-16

B. Tech 6th Semester Examination

Optical Communication (NS)

EC-324

Time : 3 Hours **Max. Marks : 100**

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : (i) Attempt five questions in all, select one question from each section A, B, C, D. Section E is compulsory.

(ii) Assume suitable data if necessary.

SECTION - A

1. (a) Briefly explain historical development of optical fiber communication. (5)

   (b) How are optical fiber advantageous in communication applications? (5)

   (c) Give the block diagram of a digital optical fiber communication system and explain the function of each block. (10)

2. (a) Explain the term mode of an optical wave guide and discuss about the different modes used in fiber guides. (5)

   (b) Define relative refractive index difference for an optical fiber and show how it may relate to numerical aperture. (5)

   (c) Explain the term graded index fiber. What are the advantages of using a graded index fiber? (5)

   (d) A graded index fiber with a parabolic refractive index profile core has relative index difference of 1% and refractive index at the core axis is 1.47. Find the maximum diameter of the fiber which gives the single mode operation at a wavelength of 1.5μm. (5)

SECTION - B

3. (a) Explain scattering effects in optical fibers and indicate the ways in which they can be avoided in optical fiber communication. (10)

   (b) Derive an expression for the rms pulse broadening due to intermodal dispersion in a multimode step index fiber. Compare this with an optimum near parabolic profile graded index fiber. (6)

   (c) A 10 km optical link consists of a multimode step index fiber with a core refractive index of 1.46 relative index difference of 1%. Find:

   (i) The delay difference between the slowest and the fastest modes at the fiber output.

   (ii) RMS pulse broadening due to intermodal dispersion on the link.

   (iii) Maximum bit rate

   (iv) Bandwidth length product corresponding to the bit rate. (4)

4. (a) Discuss two processes by which light can be emitted from an atom. Give the advantages and drawbacks for the LED in comparison with the injection laser for use as a source in optical fiber communication. (8)

   (b) State and explain basic principle of laser action in semiconductors. (6)

(c) Discuss and illustrate the various types of mismatch and resulting losses that can occur when two fibers are connected or spliced. Also explain two types of splicing methods. (6)

SECTION - C

5. (a) Discuss in detail p-i-n photodiode. How does it differs from the avalanche photodiode? (10)

(b) Discuss photo detector noise. Also find the expression of signal to noise ratio at the output of optical receiver. (10)

6. (a) Write down and explain the link design equations in a point to point communication link based on power budget and rise time budget considerations. (10)

(b) Explain the basic principle of operation of semiconductor optical amplifiers. Give classification of semiconductor optical amplifiers and explain any one in detail. (10)

SECTION - D

7. Discuss with the aid of suitable diagrams the measurement of dispersion in optical fibers. Consider both time and frequency domain measurement techniques. (20)

8. (a) How are fiber optic sensors classified? Suggest a criterion for designing an intensity modulated sensor. On what factors does the signal developed by the detector depend in this case? (10)

(b) Explain the following:

(i) Wavelenfth modulated sensor.

(ii) Intrinsic and extrinsic sensors. (10)

SECTION - E

9. (i) Discuss the three applications of optical fiber.

(ii) Whatis Snell's law? Explain total internal reflection. Why is it necessary to meet the total internal reflection inside an optical fiber?

(iii) What do you mean by term normalized frequency?

(iv) What is waveguide dispersion? Explain.

(v) Distinguish between intermodal and intramodal dispersions.

(vi) Explain the general requirements for a source in optical fiber communication.

(vii) Distinguish between spontaneous and stimulated emission.

(viii) Explain long wavelength cutoff.

(ix) What is the difference between a regenerator and an optical amplifier? (2)

(x) Convert the optical signal power 5mw and 20μw to dBm. (2×10=20)