

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

PAPER ID : 2726

Roll No.

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B.Tech.

(SEM. VII) ODD SEMESTER THEORY
EXAMINATION 2013-14

OPTICAL COMMUNICATION

Time : 3 Hours

Total Marks : 100

Note :- (i) Attempt **ALL** questions.

(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. Enlist the advantages of optical communication.
- (b) What do you mean by Acceptance Angle of an optical fiber ? Derive an expression for numerical aperture of optical fiber.
- (c) What is Total Internal Reflection ? Explain Snell's law.
- (d) Explain in brief the propagation characteristics of single and multimode fibers.
- (e) Write a short note on fabrication process of optical fiber.

- (f) What do you understand by Inter Symbol Interference (ISI)? A multimode graded index fiber exhibits total pulse broadening of $0.1 \mu\text{s}$ over a distance of 15 km. Estimate :
- (i) The maximum possible bandwidth without ISI.
 - (ii) Pulse dispersion per unit length.

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

- (a) Discuss various dispersion mechanisms.
- (b) Discuss the following terms for optical fiber :
 - (i) Absorption
 - (ii) Scattering losses.
- (c) Write a short note on Dispersion Shifted Fiber (DSF).
- (d) Enlist the polarization maintaining fibers. Two fibers having same polarization and operating at a wavelength of $0.8 \mu\text{m}$ have beat lengths of 0.5 mm and 75 m. Find the modal birefringence in each case.
- (e) Differentiate between intramodal and intermodal dispersion for step and graded index fibers.
- (f) Explain the working of a Heterodyne detection technique suitable for optical fiber communication.

3. Attempt any two parts of the following : (10×2=20)

- (a) Explain the principle of semiconductor lasers and draw the emission characteristic. A ruby laser crystal is 4 cm long ($n = 1.78$). The peak emission wavelength is $0.55 \mu\text{m}$. Determine the number of longitudinal modes and their frequency separation.
- (b) Explain the physical principle of APD. What is the temperature effect on Avalanche Gain ? Describe Automatic Gain Control using Op-Amp.
- (c) With the help of a neat block diagram, explain the principle of working of Point to Point digital links.

4. Attempt any two parts of the following : (10×2=20)

- (a) Write short notes on the following :
 - (i) WDM
 - (ii) p-i-n diode.
- (b) Discuss the various factors which effect the launching of optical signal into fiber. Determine the power coupled into step index fiber whose $n_1 = 1.48$, $n_2 = 1.46$, if surface emitting LED radiates $150 \mu\text{W}$ of power.
- (c) Discuss Hetero-Junction in Light Emitting Diode (LED). Explain the efficiency and modulation capability of LED.

5. Attempt any two parts of the following : (10×2=20)

(a) Write a short note on Optical Power Budgeting. The following parameters are established for a long haul single-mode optical fiber operating at a wavelength of $1.3 \mu\text{m}$:

- Mean power launched from the laser transmitter-3dB.
- Cable fiber loss 0.4 dB/km.
- Splices fiber loss 0.1 dB/km.
- Connection losses at the transmitter and receiver when operating at 35 M bit/sec (BER 10^{-9}) 55 dbm.
- Required safety margin 7 db.

Estimate the maximum possible link length without repeaters when operating at 35 M bit/sec. It may be assumed that there is no dispersion equalization penalty at this bit rate.

(b) Draw a block diagram and explain the principle of Coherent detection method in optical fiber.

(c) Write short notes on the following :

- (i) Optical Power Meter.
- (ii) Direct Intensity Modulation (DIM).