



SF - 8337

B. E. III (Sem. IV) (E. & C.) Examination

May / June - 2011

Optical Communication

Time : Hours]

[Total Marks : 100

Instructions :

(1)

नीचे दृष्टावेक निशानीवाणी विगतो उत्तरवडी पर अवश्य लपवी.
Fillup strictly the details of signs on your answer book.

Name of the Examination :
B. E. 3 (SEM. 4) (E. & C.)

Name of the Subject :
OPTICAL COMMUNICATION

Subject Code No. : 8 3 3 7 Section No. (1, 2,.....): Nil

Seat No. : [] [] [] [] [] []

Student's Signature

- (2) Figures to the right indicate marks.
(3) Assume suitable data if found necessary.

1 (a) Attempt the following questions : 10

- (1) Explain the advantage of optical fiber link over conventional copper system.
- (2) What requirements must be satisfied for selection of fiber material.
- (3) Draw the schematic of single fiber structure. Explain importance of each part of fiber.
- (4) Draw fiber optic transmission link along with its major elements.
- (5) What requirements must be satisfied for selection of fiber material.

(b) Attempt the following questions : 10

- (1) Explain the fabry parot resonator . What is 'population inversion' and how it can be achieve ?
- (2) Why silica is added with glass fiber ? Explain OVPO process for fiber fabrication.

2 Attempt any two : 16

- (1) What is NA ? Derive an equation of NA for step index multi mode fiber. Explain the concept of V number and its relation with modes confined into the core.
- (2) Explain the working principle of PIN photo diode and APD. What is the requirement of reverse biasing in photo detectors ? Explain importance of dark current sensitivity.
- (3) Explain different types of bending losses which results into the attenuation of signal.

3 Attempt any two : 14

- (1) Design an optical fiber communications link with a system capacity of 100 Mb/s and a length of 120 km.

Given parameters are :

- (1) splicing loss = 0.3 dB per splice dBm
(Assume every splice at 4 km)
- (2) connector loss = 2.0 dB
- (3) power margin = 12 dB
- (4) optical output power 0.5 dBm
- (5) optical fiber attenuation = 0.2 dB/km
- (6) optical receiver sensitivity = -50 .

Comment whether system is functional or not.

If system is not functional, change the design parameter in such a manner that system becomes functional.

- (2) Explain :
 - (1) fusion splicing,
 - (2) V - groove splicing and
 - (3) elastic tube techniques for fiber splicing.
- (3) Define coupling efficiency. Derive the equation for the power coupled to the step index fiber from source. For laser diode that has a lateral half power beam width of $2\theta = 10^\circ$, find lateral power distribution co-efficient.

- 4 Do as directed : (**four** marks each) **20**
- (a) Explain basic operation of general optical amplifier.
 - (b) List and explain the key system features of WDM.
 - (c) Draw and explain different network topologies.
 - (d) For a commercially available 32×32 single mode coupler made from a cascade of 3dB fused fiber 2×2 couplers, where 5 percent power lost in each element. Calculate the excess loss and splitting loss.
 - (e) Explain optical amplification and how it differs from electronic amplification.
- 5 Attempt any **two** : **14**
- (a) A 2×2 biconical tapered fiber coupler has an input optical power level of $P_0 = 200 \mu W$. The output powers at the other three ports are $P_1 = 90 \mu W$, $P_2 = 85 W$ and $P_3 = 6.3 nW$. Calculate :
 - (i) Coupling ratio,
 - (ii) Excess loss,
 - (iii) Insertion loss and
 - (iv) Crosstalk
 - (b) Explain the concept of the de - multiplexing using an optical circulator with Bragg gratings.
 - (c) Explain frequency and time domain intermodal dispersion measurement method.
- 6 Attempt any **two** : **16**
- (a) Explain Mach - Zehnder Interferometer (MZI) multiplexer in detail.
 - (b) EDFA architecture.
 - (c) Measurement of attenuation by cutback technique.
 - (d) Discuss key system features of WDM. Draw diagram of a typical WDM link containing various components and explain it in brief.