Total No. of Questions : 6]

SEAT No. : ____

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BE/INSEM/APR-565
B.E. (E & TC)
404190: BROADBAND COMMUNICATION SYSTEMS
(2015 Pattern) (Semester - II)

Time : 1 Hour] ***[Max. Marks : 30***

Instructions to the candidates:

1) ***Answer Q1. or Q2. Q3. or Q4, Q5 or Q6.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Assume suitable data, if necessary.***

Q1) a) Define and explain the following terms in context of an optical fiber: **[6]**
   i) Numerical aperture
   ii) Critical angle
   iii) Total internal reflection

   b) A step index multimode fiber with numerical aperture of 0.2 supports approximately 100 modes at 850nm wavelength. **[4]**
   i) Calculate the diameter of the core.
   ii) How many modes does the fiber support at 1310nm?

OR

Q2) a) With neat sketches explain the microbending and macrobending effects in optical fiber. How to minimize bending losses? **[6]**

   b) Explain detection process in PIN photodiode. Compare this device with APD photodiode. **[4]**

Q3) a) Make a power budget and check the system feasibility for a short-haul system of 5 Km with required data rate of 20 Mbps, BER of 1×10^{-9} errors/ bit and it is operating at λ = 850nm. The Si PIN photodiode has a receiver sensitivity of about -42 dBm. GaA1As LED can couple 50µ W into multimode fiber with a core diameter of 50µm. The connector loss is 1 dB per connector. Splices will be required at each kilometer with 0.5 dB per splicing loss, and fiber attenuation loss for the fiber is 3.5dB/km. **[6]**

   b) Enlist the system design considerations for an optical communication network. **[4]**

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OR

Q4) a) Make a rise time budget for a 0.85μm, 150km fiber link designed to operate at 622Mbps. The LED transmitter and the Si PIN receiver have rise times of 0.1ns and 0.5 ns, respectively. The graded index fiber has D = 10ps/km-nm. LED spectral width is 0.15 nm. Can the system be designed to operate with NRZ format? **[5]**

b) Find the maximum permissible link length for a lightwave system with data rate = 20 Mbps, bit error rate of 10^{-9}. **[5]**

Transmitter: GaAlAs LED can couple 60μW average optical power into the fiber.

Receiver; Silicon PIN photodiode operating at 850nm, require receiver input signal of -40dBm.

Fiber: α = 3.2 dB/km

Connector loss: 1dB.

Q5) a) A 2 × 2 fiber coupler has an input optical power level of P_0=135μW. The coupler output powers are P_1=60μW, P_2=55μW, P_3=4.3nW. Find the following coupling parameters. **[6]**

i) Splitting ratio.

ii) Crosstalk.

iii) Insertion loss.

iv) Excess loss.

b) With neat sketches explain the operation of FBG based optical add/drop multiplexer. **[4]**

OR

Q6) a) With the help of neat sketch describe WDM architectures. **[6]**

b) Explain the different possible applications of optical amplifier in a practical fiber optic communication system. **[4]**

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