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**Seventh Semester B.E. Degree Examination, June/July 2014**  
**Optical Fiber Communication**

Time: 3 hrs.

Max. Marks:100

**Note: Answer any FIVE full questions, selecting  
atleast TWO questions from each part.**

**PART – A**

- 1
  - a. Discuss the inherent advantages and disadvantages of optical fiber communication system. (06 Marks)
  - b. With relevant ray diagram, explain the different structure of fibers considering the number of modes. (06 Marks)
  - c. Explain the different fiber material used in optical fibers. (05 Marks)
  - d. Explain mode field diameter. (03 Marks)
  
- 2
  - a. Explain the following losses in optical fibers: i) Bending losses; ii) Polarized mode dispersion loss. (06 Marks)
  - b. Prove that the delay difference between the axial ray and extreme meridional ray  

$$\delta_{ts} = \frac{Ln_1\Delta}{C}$$
 (08 Marks)
  - c. A 30km long fiber at 1300nm has an attenuation of 0.8 db/km. If 200  $\mu$ W power is launched into the fiber, find the output power in dbm and in Watts? (06 Marks)
  
- 3
  - a. Explain working of double hetero junction edge emitting LED. (06 Marks)
  - b. What is quantum efficiency? How are responsivity and quantum efficiency are related? (04 Marks)
  - c. A given silicon APD has quantum efficiency of 65% at  $\lambda = 900$ nm. Suppose 0.5 $\mu$ W of optical power produces a multiplied photocurrent of 10 $\mu$ A. Find the primary photo current and multiplication factor. (06 Marks)
  - d. Give comparison between PIN diode and avalanche photo diode. (04 Marks)
  
- 4
  - a. Explain different types of fiber splicing techniques with neat diagrams. (06 Marks)
  - b. What are the principal requirements of a good connector design, explain basic coupling mechanism, used in Butt joint and expanded-beam connector with relevant diagram. (10 Marks)
  - c. A optical fiber has a core refractive index of 1.5. Two lengths of the fiber with smooth and perpendicular end faces are butted together. Assuming the fiber axes are perfectly aligned. Calculate the optical loss in decibel at the joint due to fresnel reflection when there is a small air gap between the fiber end faces. (04 Marks)

**PART – B**

- 5
  - a. With a neat diagram, explain working of optical receiver? (06 Marks)
  - b. Explain the quantum limit for optical  $R_x$ . (04 Marks)
  - c. Derive the equation for the performance fidelity of an analog receiver. Substantiate that for large optical signal, SNR represents the quantum limit for receiver sensitivity. (10 Marks)

- 6 a. Discuss the basic elements of an analog link and the major noise contributors of an analog link with neat diagram. (08 Marks)
- b. Explain sub carrier multiplexing. (06 Marks)
- c. Discuss the various parameters involved in optical link rise time budget with relevant equation. (06 Marks)
- 7 a. Explain key system features of WDM? (04 Marks)
- b. With neat schematic explain  $2 \times 2$  coupler and list the various losses for specifying the performances of an optical coupler. (06 Marks)
- c. Explain the functioning of Mach Zender interferometer. (06 Marks)
- d. Explain the functioning of optical isolator with sketches of components involved. (04 Marks)
- 8 a. Explain in detail the amplification mechanism with energy level diagram in Erbium doped fiber amplifier EDFA. (08 Marks)
- b. Draw and explain basic structure of an STS-N SONET and STM-N SDH frame format. (06 Marks)
- c. With neat sketch, explain UPSR and BLSR architecture of SONET/SDH networks. (06 Marks)

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