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**Seventh Semester B.E. Degree Examination, Dec.2015/Jan.2016**  
**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. Differentiate between :
  - i) single mode and multimode fibers
  - ii) step index and graded index multimode fibers. (10 Marks)
- b. What are the different types of fiber materials used in optical fibers, explain briefly. (06 Marks)
- c. A MMGI fiber has a core with a parabolic refractive index profile, with a diameter of 60  $\mu\text{m}$ . The fiber has an NA of 0.2. Estimate the total number of propagating modes at a wavelength of 1  $\mu\text{m}$ . (04 Marks)
  
- 2 a. Explain the material absorption mechanism in an optical fiber. (10 Marks)
- b. Derive the expression for material absorption in an optical fiber. (06 Marks)
- c. A MMGI fiber has a core refractive index of 1.46, cladding RI of 1.45. The critical radius of curvature at which maximum bending loss occurs is 0.84  $\mu\text{m}$ . Determine wavelength of the transmitted light. (04 Marks)
  
- 3 a. Derive the expression for quantum efficiency and output power for an LED. (08 Marks)
- b. Describe the different noise sources affecting the photo detector along with expressions and derive the expression for the S/N ratio at the O/P of the photo detector. (08 Marks)
- c. The quantum efficiency for an APD is 90%. Find the responsivity at 1600 nm. (04 Marks)
  
- 4 a. Name the different types of fiber joints. Explain the types of mechanical misalignments while joining two fibers. (07 Marks)
- b. Explain the three types of fiber splicing techniques with neat diagram. (09 Marks)
- c. An optical fiber has a core RI of 1.5. Two perfectly aligned optical fiber lengths one butted together. Calculate the optical loss in decibels at the joints when there is an air gap between the fiber end faces. (04 Marks)

**PART – B**

- 5 a. Draw the signal path through an optical digital link showing all the relevant waveforms. (06 Marks)
- b. Draw and explain the two general heterodyne receiver configurations, along with the relevant expressions for BER. (08 Marks)
- c. Draw and explain the two types of front end amplifiers in optical fiber communication. (06 Marks)

- 6 a. Draw the block diagram, and explain the multichannel amplitude modulation technique used in fiber optics. (08 Marks)
- b. Explain the significance of link power budget and system margin. The following optical link parameters are given :
- |                                  |             |
|----------------------------------|-------------|
| Optical power launched           | = 6 dBm     |
| Receiver sensitivity             | = -25 dBm   |
| Source 1 detector connector loss | = 1 dB      |
| Fiber cable length               | = 100 km    |
| Cable attenuation                | = 0.1 dB/km |
| Jumper cable loss                | = 3 dB      |
| Connector loss at each joint     | = 1dB       |
- Assume two jumper cables and two cable joints. Compute link power margin. (06 Marks)
- c. Derive the total system rise time expression for a digital optical link. (06 Marks)
- 7 a. With the help of a diagram, explain the principle of WDM. (08 Marks)
- b. Draw and explain the operation and design of :
- Optical isolators
  - Mems technology
  - Tunable optical filters. (12 Marks)
- 8 Write short notes on :
- EDFA amplifier
  - SONET/SDH. (20 Marks)

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