

**GUJARAT TECHNOLOGICAL UNIVERSITY****BE - SEMESTER-VI • EXAMINATION – SUMMER 2013****Subject Code: 161005****Date: 30-05-2013****Subject Name: Optical Communication****Time: 10.30 am - 01.00 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1 Answer The following 14**
- (a) Give in brief the comparison of S.I. and G.I. fibers. **04**
  - (b) What is equilibrium numerical aperture. Give the significance of the same. **04**
  - (c) Define the following terms related to photo detector. **03**
    - (i) Responsivity (ii) Quantum efficiency (iii) Cut off wavelength
  - (d) Mention the principal requirements of good optical fiber connectors. **03**
- Q.2 (a) Derive the equation for the power launched from LED Source in to a S.I. fiber. 07**
- (b) A train of light pulses is transmitted through a 400 m fiber with  $n_{\text{core}}=1.4$  and  $n_{\text{clad}}=1.36$ . Sketch the output pulses for. 07**
- (i) A pulse rate of  $10 \times 10^6$  pulses per sec (10 Mb/s)
  - (ii) A pulse rate of  $20 \times 10^6$  pulses per sec (20 Mb/s)
- Also find dispersion per km. for each assume that the input pulse is of near zero width.
- OR**
- (b) A G.I. fiber has a core with a parabolic refractive index profile which has a diameter of  $50 \mu\text{m}$ . The fiber has a numerical aperture of 0.22. Estimate the total no. of guided modes propagating in the fiber when it is operating at a wavelength of  $1 \mu\text{m}$ . 07**
- Q.3 (a) Discuss briefly the fabry perrot resonator cavity LASER with neat sketch. 05**
- (b) A Laser diode has lateral  $\theta = 0^\circ$  and transverse  $\theta = 90^\circ$  half power beam widths of  $2\theta = 60^\circ$  and  $30^\circ$  respectively what are transverse and lateral power distribution coefficient for this device? 05**
- (c) Explain block diagram of optical communication system with neat sketch mentioning functions of each block. 04**
- OR**
- Q.3 (a) Discuss briefly the structure of surface emitting LED with neat sketch. 05**
- (b) A photo diode has a quantum efficiency of 75% when photons of energy  $1.5 \times 10^{-19} \text{ J}$  are incident upon it. 05**
- (i) At what wavelength is the diode operating?
  - (ii) Calculate the incident optical power required to obtain a photo current of  $3.5 \mu\text{A}$ .
- (c) The optical power launched into a fiber does not depend on the wavelength of the source but only on its brightness. Justify. 04**
- Q.4 (a) Discuss optical power loss model for a point to point link. 05**
- (b) A typical LED emits light at a center wavelength of  $820 \text{ nm}$  with  $\Delta\lambda = 20 \text{ nm}$ , Calculate the relative line width of this source in percent and  $\Delta f$ . 05**
- (c) A silicon APD has a quantum efficiency of 75 % at a wavelength of  $900 \text{ nm}$ . If  $0.5 \text{ mw}$  of optical power produces a multiplied photo current of  $10 \text{ mA}$ , then what is avalanche gain for this device. 04**
- OR**
- Q.4 (a) Describe briefly the losses in optical fibers. 05**

- (b) A silicon APD has a quantum efficiency of 75 % at a wavelength of 900 nm. If 0.5 mw of optical power produces a multiplied photo current of 10 mA, then what is avalanche gain for this device. **05**
- (c) Give the comparison of S.M. and M. M. fibers **04**
- Q.5** (a) Discuss Optical fiber splicing techniques in detail. **07**
- (b) Discuss Optical Time Domain Reflectometry in detail. **07**
- OR**
- Q.5** (a) Explain Erbium Doped Fiber Power amplifiers(EDFAs) **07**
- (b) Write short notes on Synchronous optical fiber networks(SONET) **07**

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