

Seat No.: \_\_\_\_\_

Enrolment No. \_\_\_\_\_

**GUJARAT TECHNOLOGICAL UNIVERSITY**

**M. E. - SEMESTER – I • EXAMINATION – SUMMER • 2014**

**Subject code: 710405**

**Date: 30-06-2014**

**Subject Name: Fiber Optic Communication**

**Time: 02:30 pm - 05:00 pm**

**Total Marks: 70**

**Instructions:**

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

**Q.1. Answer the following. (14)**

- (a) A Laser diode has lateral  $\theta = 0^\circ$  and transverse  $\theta = 90^\circ$  half power beam width of  $2'' = 60^\circ$  and  $30^\circ$  respectively what are transverse and lateral power distribution coefficient for this device? (5)
- (b) A multimode step index fiber with a core diameter of  $80\mu\text{m}$  and a relative index difference of 1.5% is operating at a wavelength of  $0.85\mu\text{m}$ . If the core refractive index is 1.48 calculate the normalized frequency for the fiber and the number of guided modes. (5)
- (c) A typical LED emits light at  $\lambda_0 = 820\text{ nm}$  with  $\Delta\lambda = 40\text{ nm}$ . Compute the relative Line width in % and  $\Delta f$ . (4)

**Q.2. (14)**

- (a) Discuss Modal analysis of step index fiber with necessary equations. (7)
- (b) Discuss briefly the DFB LASER with neat sketch and explain how it works as a LASER. (7)

**OR**

- (b) Consider a fiber with a  $25\mu\text{m}$  core radius, a core index  $n_1 = 1.48$  and  $\Delta = 0.001$ .
  - (i) If  $\lambda = 1320\text{ nm}$ , what is the value of  $V$  and how many modes propagates in the fiber? (7)
  - (ii) What percent of the optical power flows in the cladding?
  - (iii) If the core-cladding difference is reduced to 0.002, how many modes does the fiber support and what fraction of the optical power flows in the cladding?

**Q.3. (14)**

- (a) Discuss EDFA Power conversion efficiency and Gain with necessary formulas. (7)
- (b) Derive the formula for optical SNR for EDFPA. (7)

**OR**

**Q.3. (14)**

- (a) Explain typical setup for Raman amplification system also discuss wideband optical amplifiers in series and parallel configuration. (7)
- (b) Discuss spectral broadening of a pulse due to self-phase modulation. (7)

**Q.4 (14)**

- (a) Briefly Describe  $4 \times 4$  optical cross-connect architecture using optical space switches and wavelength converters. (7)
- (b) Discuss coupled mode analysis of optical directional couplers. (7)

**OR**

**Q.4 (14)**

- (a) Discuss Optical link design with BER calculation by suitable example. (7)
- (b) Describe amplification concept for operation in the C-and S-bands for WDM. (7)

**Q.5 (14)**

- (a) A silicon RAPD operating at a wavelength of  $0.80\mu\text{m}$  exhibits a quantum efficiency of 90% a multiplication factor of 800, and a dark current of 2 nA. Calculate the rate at (7)

which photons should be incident on the device so that the output current (after avalanche gain) is greater than the dark current.

**(b)** Explain any one method for optical attenuation measurement in OFC. (7)

OR

**Q.5** (14)

(a) Write short note on role of Optical Time Domain Reflectometry (OTDR) for fibers measurement techniques.

(b) Write short note on electro-optic switches.

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