Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME - SEMESTER– 1 EXAMINATION – WINTER 2014

Subject Code: 2710503 Date:07/01/2015

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 marks.**

Q.1 **(a)** Define (i) Fiber Birefringence (ii) Attenuation in Fiber (iii) Fiber optic Modes **07**

(b) Solve the following example: **07**

i) Find the core radius necessary for single ï mode operation at 1310 nm of a step-index fiber with core index 1.480 and cladding index 1.478 . What are the numerical aperture and maximum acceptance angle of this fiber?

ii) A point source of light is 14 cm below the surface of a large body of water (n= 1.33 for water). What is the radius of the largest circle on the water surface through which the light can emerge?

Q.2 **(a)** Enlist the Advantages of Optical Fiber Communication. **07**

(b) Describe with the aid of simple ray diagrams: **07**

(a) The multimode step index fiber;

(b) The single-mode step index fiber.

Compare the advantages and disadvantages of these two types of fiber for use as an optical channel.

OR

(b) A Graded index fiber has a core with a parabolic refractive index profile which has a diameter of 50εm.The fiber has a numerical aperture of 0.2. Estimate the total number of guided modes propagating in the fiber when it is operating at a wavelength of 1εm. **07**

Q.3 **(a)** Enlist Nonlinear Effects in Fiber Optic Link. **07**

(b) Two step index fibers exhibit the following parameters: **07**

(a) A multimode fiber with a core refractive index of 1.5, a relative refractive index difference of 3% and an operating wavelength of 0.82 μm;

(b) An 8 μm core diameter single-mode fiber with a core refractive index the same as (a), a relative refractive index difference of 0.3% and an operating wavelength of 1.55 μm.

Estimate the critical radius of curvature at which large bending losses occur in both cases.

OR

Q.3 **(a)** Explain (i) PMD Compensation (ii) Fiber Bragg Gratings. **07**

(b) Describe the three types of fiber misalignment which may contribute to insertion loss at an optical fiber joint. **07**

A step index fiber with a 200 µm core diameter is butt jointed. The joint which is index matched has a lateral offset of 10 µm but no longitudinal or angular misalignment. Using two methods, estimate the insertion loss at the joint assuming uniform illumination of all guided modes.

Q.4 **(a)** The refractive index of the InGaAsP active region of an injection laser at a wavelength of 1.5 µm is 3.5 and the device has an active cavity length of 400 µm. for laser operation at a wavelength of 1.5 µm. Determine: (a) the laser emission mode index; (b) the eligible number of wavelengths inside the cavity; (c) the frequency separation of the modes in the active cavity in order to produce constructive interference. **07**

(b) Compare APD ï PIN Photo detector. **07**

OR

Q.4 **(a)** Describe key features of WDM system. **07**

(b) Explain key system requirements in analyzing point to point link. Also calculate Rise Time Budget **07**

Q.5 **(a)** Explain Eye Pattern measurement technique. **07**

(b) Write a short note on (i) Raman Amplifier & (ii) EDFA **07**

OR

Q.5 **(a)** Describe SONET frame structure along with protection schemes. **07**

(b) A 2*2 biconical tapered fiber coupler has an input optical power level of P_0=200ε w.The output powers at the other three ports are P_1=80 ε w, P_2=75 ε w and P_3=6.3nW. Find **07**

(1) Coupling Ratio
(2) Excess Loss
(3) Insertion Losses
(4) Crosstalk

****