Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC SEMESTER V– EXAMINATION – SUMMER 2017

Subject Code: X51102 **Date: 02/05/2017**
Subject Name: Optical Communication
Time: 02.30PM to 05.00PM **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)** Draw a typical optical fiber transmission link showing all major elements. Also list out the advantages of the optical communication system using optical fiber over conventional copper system. **07**

(b) Explain the Snell's law for TIR. Derive the expression of numerical aperture for step index fiber. **07**

Q.2 **(a)** Justify the following statements: **07**

1) A mode remains guided as long as propagation factor β satisfies the condition $n_2k < \beta < n_1k$.
2) Signal distortion mechanism in optical fiber limits the information rate of the signal.

(b) Solve the followings: **07**

1) The refractive index of the core and cladding of a silica fiber are 1.48 and 1.46, respectively. What is the critical propagation angle and acceptance angle ?
2) A multimode step index fiber with a core diameter of 80 µm and a relative index difference of 1.5 % is operating at a wavelength of 0.85 µm. If the core refractive index is 1.48, estimate the normalized frequency for the fiber and the number of guided modes.

OR

(b) Derive the expression for the power coupled from the LED to the step index fiber in terms of Numerical Aperture and Power supplied. **07**

Q.3 **(a)** Enlist the basic attenuation mechanisms in fiber, and discuss any two in brief. **07**

(b) Enlist the fiber fabrication techniques, explain any one in brief. **07**

OR

Q.3 **(a)** Explain splicing techniques and enlist the characteristics of optical fiber Connectors. **07**

(b) Write a brief note on SONET/SDH. **07**

Q.4 **(a)** Explain the light generating mechanisms in LASER. Also write a brief note on population inversion. **07**

(b) Explain the optical receiver operation with necessary block diagram and waveforms. **07**

OR

Q.4 **(a)** Define two important characteristics of photo detector, and Describe the working of RAPD with neat sketch. **07**

(b) Solve the followings: **07**

1) A silicon avalanche photodiode has a quantum efficiency of 65 % at a wavelength of 900 nm. If 0.5 μW of optical power produces a multiplied photo current of 10 μA. Determine the multiplication factor M.
2) An InGaAs pin photodiode has the following parameters at a wavelength 1300 nm: I_D = 4 nA, η = 0.90, R_L = 1000 Ω, and the surface leakage current is negligible. The incident power is 300 nW(-35 dBm), and receiver bandwidth is 20 MHz. Determine mean square quantum noise current, mean square dark current and mean square thermal noise current.

Q.5 **(a)** Describe key system requirements needed for analyzing point to point link, discuss the component selection for the same based on the characteristics of the Components. **07**

(b) Explain optical time domain reflectometer and describe the OTDR trace. **07**

OR

Q.5 **(a)** Write a brief note on optical add drop multiplexer. **07**

(b) Describe the insertion loss method for optical attenuation measurement. **07**

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