Seat No.: _____   Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY
B. E. - SEMESTER – VI • EXAMINATION – WINTER 2012

Subject code: 161005   **Date: 07/01/2013**
Subject Name: Optical Communication
Time: 02.30 pm - 05.00 pm   **Total Marks: 70**
Instructions:
    1. **Attempt any five questions.**
    2. **Make suitable assumptions wherever necessary.**
    3. **Figures to the right indicate full marks.**

Q.1 **(a)** Using simple ray theory, describe the mechanism for the transmission of **07**
light within an optical fiber and show how acceptance angle is related to
the fiber numerical aperture.

(b) Describe multimode step index, single mode step index and graded index **07**
fiber with the aid of simple ray diagrams. Compare the advantages and
disadvantages of these fibers for use as an optical channel.

Q.2 **(a)** Indicate the major advantages of vapor-phase deposition in the **07**
preparation of glasses for optical fibers. Briefly describe the various
vapor-phase techniques.

(b) A 15 km optical fiber link uses fiber with a loss of 1.5 dB/km. The fiber is **07**
jointed every kilometer with connectors which give an attenuation of 0.8
dB each. Determine the minimum mean optical power which must be
launched into the fiber in order to maintain a mean optical power level of
0.3 µW at the detector.

OR

(b) A step index fiber in air has a numerical aperture of 0.16, a core refractive **07**
index of 1.45 and a core diameter of 60 µm. Calculate refractive index of
cladding, relative refractive index difference (Δ) and acceptance angle.
Determine the normalized frequency for the fiber when light at a
wavelength of 0.9 µm is transmitted. Further, estimate the number of
guided modes propagating in the fiber.

Q.3 **(a)** Explain the principles of operation of the laser using suitable diagrams. **07**
(b) Briefly discuss the possible sources of noise in optical receivers. **07**
OR
Q.3 **(a)** Briefly discuss the advantages and drawbacks of the LED in comparison **07**
with the laser for use as a source in optical fiber communication. List
different types of LEDs.

(b) Explain detection process in the *p-n* photodiode. Define the quantum **07**
efficiency and responsivity of a photo detector.

Q.4 **(a)** What is splicing? Explain different techniques of splicing. **07**
(b) Write a short note on fiber amplifiers. **07**
OR
Q.4 **(a)** Explain Optical Time Domain Reflectometry (OTDR) method with its **07**
benefits over other techniques.
Q.4 **(b)** Write a short note on fiber connectors. **07**

Q.5 **(a)** Outline the applications of Optical Communication and briefly explain **07**

SONET (Synchronous Optical Network).

(b) A photodiode has a quantum efficiency of 65 % when photons of energy **07** 1.5×10^{-19} J are incident upon it. Calculate operating wavelength of photodiode and incident optical power required to obtain a photocurrent of 2.5 µA when the photodiode is operating at the same wavelength.

OR

Q.5 (a) Write a brief note on Optical Couplers. **07**

(b) What is dispersion in optical fiber? Classify different dispersion with **07** reasons. Explain its effect in optical communication. How to reduce the effect of dispersion?

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