Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E –IIst SEMESTER–EXAMINATION – JULY- 2012

Subject code: 1710405 **Date: 16/07/2012**

Subject Name: Fiber Optic Communication

Time: 10:30 am – 13:00 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)What are the advantages of fiber optic communication ? 07

(b)A typical relative refractive index difference for an optical fiber designed for Long distance transmission is 1% .Estimate the NA and the solid acceptance Angle in air for the fiber when the core index is 1.46.further calculate the critical Angle at the core –cladding interface within the fiber.It may be assumed that the Concepts of geometric optics hold for the fiber. 07

Q-2(a)With neat figures explain the refractive index profile and ray transmission in : 07
1)Step index fiber.
2)Graded index fiber.

(b) A multi mode step index fiber with core diameter of 80µm 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: 07
1)The normalized frequency for the fiber.
2)The guided modes.

OR

(b)A graded index fiber has a core with parabolic refractive index profile which has a diameter of 50µm.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 wave length of 1µm. 07

Q-3(a)A graded index fiber with a parabolic refractive index profile core has a refractive Index at the core axis of 1.5 and a relative index difference of 1%.Estimate the maximum Possible core diameter which allows single mode operation at a wavelength of 1.3µm. 07

(b)Explain linear scattering losses in optical fiber. 07

OR

Q-3(a)Silica has an estimated fictive temperature of 1400K with an isothermal Compressibility Of $7x10^{-11}m^2N^{-1}$.The refractive index and the photo elastic co-efficient for silica are 1.46 and 0.286 respectively. Determine the theoretical attenuation in dB per kilometer Due to fundamental Rayleigh scattering in silica at optical wavelength of 0.63,Boltzmann's constant is $1.381x10^{-23}JK^{-1}$. 07

(b)Explain non linear scattering losses in optical fiber. 07

Q-4 (a)What is intramodal dispersion ?Derive the equation for material dispersion Parameter M. 07

(b)A glass fiber exhibits material dispersion given by $|\lambda^2(d^2n_1/d\lambda^2)|$ of 0.025. Determine the material dispersion parameter at a wavelength of 0.85µm. And estimate the rms pulse broadening per kilometer for a good LED source With an rms spectral width of 20nm at this wavelength. 07

OR

Q-4 (a)Draw and explain the structure of edge Emitter LED. 07

(b)A planner LED is fabricated from gallium arsenide which has refractive index of 3.6 .[1] Calculate the optical power emitted into air as a % of internal optical power For the device when the transmission factor at the crystal-air interface is 0.68. [2]When the optical power generated internally is 50% of electrical power supplied Determine the external power efficiency. 07

Q-5 (a) Draw and explain the structure of : 07

1.Front illuminated silicon P-I-N photo diode.

2.Side illuminated silicon P-I-N photo diode.

(b) A photo diode as a quantum efficiency of 65% when photons of energy 1.5×10^{-19}J are incident upon it . 07

1)At what wave length is the photo diode operating?

2)Calculate the incident optical power required to obtain a photo current of 2.5µA when the photo diode is operating as described above.

OR

Q-5(a) With neat diagram explain the optical time domain refletometry (OTDR) or the Back scatter measurement method in optical fiber .Also give an illustration of a Possible Back scatter plot from a fiber under test. 07

(b) With neat schematic diagram explain the Modified Chemical Vapour Deposition (MCVD) method for the preparation of optical fiber. 07

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