Seat No.: _____ *Enrolment No._____*

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. Sem. – II[nd] - Examination – June/July- 2011

Subject code:1710405

Subject Name:Fiber Optic Communication

Date:27/06/2011 **Time: 10:30 am – 01:00 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) Define with necessary figures: **07**

1).Total internal reflection.

2). Snell's law.

3).Numerical Aperture.

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 **07**

Difference of 1.5% is operating at a wavelength of 0.85 μm.if the core refractive

Index is 1.48. Estimate:

1)The normalized frequency for the fiber.

2)The guided modes.

OR

(b) Explain the linear scattering losses briefly. **07**

Q-3(a) Explain: **07**

1)Material dispersion.

2)Wave guide dispersion.

(b) A 6km optical link consists of multi mode step index fiber with a core refractive Index of 1.5 and a relative refractive index of difference of 1%.Estimate: **07**

1) The delay difference between the slowest and fastest modes at the fiber output.

2) The rms pulse broadening due to intermodal dispersion on the link.

3) The maximum bit rate that may be obtained without substantial errors on the link Assuming only intermodal dispersion .

4) The bandwidth – length product corresponding to (3).

OR

Q-3(a) When the mean optical power launched into an 8km length of fiber is 120μW the mean optical power at the fiber output is 3 μW. Determine: **07**

1) The overall signal attenuation or loss in db through the fiber assuming there are no connectors or splices.

2) The signal attenuation /km.

3) The overall signal attenuation for 10km optical link using the same fiber with splices at 1km intervals each giving an attenuation of 1db.

4) The numerical input/output power ratio in (3).

(b) With neat figures explain the classification of optical fiber couplers in detail. **07**

Q-4 (a) Explain the basic concept of laser and with energy state diagram describe the absorption and emission of radiation in laser. **07**

(b) With neat diagram explain the principle of operation of double heterojunction LED. **07**

OR

Q-4 (a) With neat diagram explain the working principle of P-I-N photo diode **07**

(b) A photo diode as a quantum efficiency of 65% when photons of energy **07**
1.5 $X10^{-19}$J are incident upon it .

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.

Q-5 (a) With neat diagram explain the optical time domain refletometry (OTDR) or the Back scatter measurement method in detail. **07**

(b) Draw and explain three possible configuration of an Erbium Doped Fiber Amplifier (EDFA). **07**

OR

Q-5(a) A silica optical fiber with a core diameter large enough to be considered by ray Theory analysis has a core refractive index of 1.50 and a cladding refractive Index of 1.47 .Determine: **07**

1)The critical angle at the core – cladding interface.

2)The NA for the fiber

3)The acceptance angle in air for the fiber .

(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**

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