

**GUJARAT TECHNOLOGICAL UNIVERSITY****ME - SEMESTER– II (Old course)• REMEDIAL EXAMINATION – SUMMER 2015****Subject Code: 1710405****Date:19/05/2015****Subject Name: Fiber Optic Communication****Time: 02:30 pm to 5:00 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 do you mean by NA for optical fiber? Derive relationship between acceptance angle and refractive indices of three different media like core, cladding and air is represented by  $NA = n_1 (2)^{1/2}$ . **07**
- (b) Estimate maximum core diameter for optical fiber with same relative refractive index difference is 1.5% and core refractive index is 1.48, as fiber is single mode fiber. Optical fiber cable is operating at wavelength of 0.85μm. estimate new maximum core diameter for single mode operation when relative refractive index difference is reduced by factor of 10. **07**
- Q.2** (a) Explain in brief dispersion. How it affects the band width of optical fiber communication? show that the delay difference between extreme meridional rays and axial ray in multimode step index fiber is **07**
- $$\delta T_s = \frac{L(NA)^{1/2}}{2n_1 C}$$
- (b) A multimode graded index fiber exhibits total pulse broadening of 0.2μs over a distance of 17 km. Estimate: **07**
- 1) Maximum possible band width on the link assuming no ISI
  - 2) Pulse dispersion per unit length
  - 3) Band width length product for fiber
- OR**
- (b) Explain in brief signal degradation on OFC. Also explain various types of attenuation losses in optical fiber cable. **07**
- Q.3** (a) Explain basic concept of LASER diode with energy state diagram and derive Laser diode rate equation. **07**
- (b) Compare electrical and optical band width for optical fiber communication system. Also develop a relationship between them. **07**
- OR**
- Q.3** (a) Explain with neat sketch reach through APD along with necessary equations. **07**
- (b) A photo diode has a quantum efficiency of 65% when photons of energy  $1.5 \times 10^{-19} \text{J}$  are incident on it. **07**
- 1) At what wave length photo diode is operating?
  - 2) Calculate incident optical power required to obtain photo current of 2.5μA when photo diode is operating as described above.
- Q.4** (a) Explain with diagram principle operation of double hetro junction LED. **07**
- (b) The quantum efficiency of RAPD is 80% for detection of radiation at wave length of 0.9μm. when incident optical power is 0.5μA the output current from the device is 11μA. determine the multiplication factor of photo diode under these condition. **07**

**OR**

- Q.4 (a)** Compare PIN photo diode and APD with respect to construction, principle of operation and characteristics. **07**
- (b)** A four port multimode FBT coupler has  $60\mu\text{W}$  optical power launched in to port 1. The measured output power at port 2, 3, &4 are  $0.004\mu\text{W}$ ,  $26.0\mu\text{W}$  &  $27.5\mu\text{W}$  respectively. Determine Excess loss, insertion loss between input and output port and return loss and split ratio for device. **07**
- Q.5 (a)** Draw and explain three possible configuration of EDFA. **07**
- (b)** With neat sketch explain OTDR or back scatter measurement method in optical fiber. Also give illustration of possible back scatter plot from fiber test. **07**
- OR**
- Q.5 (a)** What is the difference between optical amplifier and electrical amplifier? Explain external pumping current for optical amplifier and derive expression for steady state gain per unit length. **07**
- (b)** What is splicing? Describe various types of splicing techniques with necessary figures. **07**

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