

GUJARAT TECHNOLOGICAL UNIVERSITY**BE SEM-VI Examination-Nov/Dec-2011****Subject code: 161005****Date: 30/11/2011****Subject Name: Optical Communication****Time: 10.30 am -1.00 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) Derive the equation of power coupling from LED source to step index fiber: (1) when source radius is less than fiber radius (2) when source radius is greater than the fiber radius. **07**

(b) Explain the fiber fabrication technique along with the schematic of a fiber drawing apparatus. Also explain the outside vapor phase oxidation technique for fiber fabrication. **07**

Q.2 (a) Explain the major elements of the optical fiber transmission link. **07**

The refractive index of the core of step index fiber is 1.46 and the relative refractive index difference between core and cladding of the fiber is 2%. Estimate (1) Numerical Aperture (2) Critical angle at the core cladding interface within the fiber.

(b) A continuous 12 km long optical fiber link has a loss of 1.5 dB/km: (a) What is the minimum optical power level that must be launched into the fiber to maintain an optical level of 0.3 μ W at the receiving end. (b) What is the required input power if the fiber has a loss of 2.5 dB/km **07**

OR

(b) Explain difference between micro bending and macro bending loss. **07**

An optical signal at a specific wavelength has lost 55% of its power after traversing 3.5 Km of fiber. What is the attenuation in dB/km of this fiber?

Q.3 (a) Explain the high radiance surface emitting LED. Highlight the drawbacks of same and how it can reduce with the help of edge emitting LED. **07**

(b) Explain (1) fusion splicing, (2) V-groove splicing and (3) elastic tube techniques for fiber splicing. **07**

OR

Q.3 (a) How amplification is achieved in (1) EDFA (2) Raman Amplifier. **07**

(b) To transmit NRZ data stream of 20Mbps, calculate rise time budget for a multi rate link by assuming LED drive circuit rise time of 15 ns. The spectral width of LED is considered as 40 nm over the 6 km link and receiver has 25 MHz bandwidth. The selected fiber has 400MHz*km bandwidth distance product with $q=0.7$ **07**

Q.4 (a) Discuss key system features of WDM. Draw diagram of a typical WDM link containing various components and explain it in brief. **07**

(b) For a 2x2 fiber coupler show that the phase of the driven fiber always lags 90° behind the phase of the driving fiber. Also define the following related to optical coupler: (1) splitting ration (2) Excess loss (3) Insertion loss (4) Crosstalk **07**

OR

- Q.4** (a) Explain the performance of passive linear bus and also prove that optical power available at a particular node decreases with increasing distance from source. **07**
- (b) Explain Generic two fiber unidirectional network path switched ring with a counter rotating protection and architecture of four fiber bidirectional line switched ring. Also enlist advantages of BLSR over UPSR. **07**
- Q.5** (a) Explain the OTDR field applications and distinct features of backscattered waveform. **07**
- (b) Explain the following terms relating to PIN photodiode with proper expressions. (i) Cut-off wavelength (ii) Quantum efficiency (iii) Responsivity. Also state the typical responsivities of pin photodiodes. **07**

OR

- Q.5** (a) Explain basic parameters in reflection grating and formation of Bragg grating in a fiber core by means of two intersecting ultraviolet light beams. **07**
- (b) Explain Mach-Zehnder Interferometer (MZI) multiplexer in detail. **07**
- In 2×2 MZIs, the input wavelengths are separated by 10GHz. The silicon waveguide has $\eta_{\text{eff}} = 1.5$. Compute the waveguide length difference.
