

GUJARAT TECHNOLOGICAL UNIVERSITY
PDDC - SEMESTER – V • EXAMINATION – WINTER 2012

Subject code: X 51102**Date: 17/01/2013****Subject Name: Optical Communication****Time: 02.30 pm - 05.00 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) Draw the block diagram for optical communication link. Discuss the attractive features of the optical communication. **07**
- (b) Explain the snell's law for TIR. Derive the expression of numerical aperture for step index fiber. **07**

- Q.2** (a) Solve the followings. **07**
- i) A silica optical fiber with a core diameter large enough to be ray theory analysis has a core refractive index of 1.50 and a cladding refractive index of 1.47. Determine
- a) Critical angle at core cladding interface.
 - b) Numerical aperture for the fiber.
 - c) The acceptance angle in air for the fiber.
- ii) A multimode step index fiber with a core diameter of 80 μm and relative index difference of 1.5% is operating at a wavelength of 0.85 μm . If core refractive index is 1.48 estimate a) normalized frequency for the fiber b) number of guided modes supported by the fiber.

- (b) Compare graded index fiber & step index fiber. **07**

OR

- (b) Enlist the fiber fabrication methods & explain outside vapor phase oxidation with neat sketch. **07**

- Q.3** (a) Define the term attenuation & explain the basic attenuation mechanism in brief. **07**
- (b) When the mean optical power launched in to an 8 km length fiber is 120 μW , the mean optical power at fiber output is 3 μW . Determine
- a) Signal attenuation in dB per km
 - b) Overall signal attenuation for 10 km optical link using the same fiber with splices at 1 km intervals, each giving attenuation of 1 dB.
 - c) Numerical input/output power ratio in b)

OR

- Q.3** (a) Explain in brief synchronous optical network. **07**
- (b) Classify the optical amplifier, and discuss semiconductor optical amplifier. **07**

- Q.4** (a) Draw with neat & clean sketch edge emitting double hetrojunction LED & explain the same. **07**

- (b) Determine the emission wavelength for given light source material 07
 a) $\text{Ga}_{1-x}\text{Al}_x\text{As}$, $x = 0.07$
 b) $\text{In}_{0.74}\text{Ga}_{0.26}\text{As}_{0.57}\text{P}_{0.43}$
- OR**
- Q.4 (a) Define two important characteristics of photodetector, and Describe the working of RAPD with neat sketch. 07
- Q.4 (b) Solve the followings. 07
 i) A double heterojunction InGaAsP LED emitting at a peak wavelength of 1310 nm has radiative & nonradiative recombination times of 30 ns and 100 ns, respectively. Determine the internal quantum efficiency & optical power generated internally for 40 mA drive current.
 ii) When 3×10^{11} photons each with a wavelength of 0.85 μm are incident on a photodiode, on average 1.2×10^{11} electrons are collected at the terminals of the device. Determine the quantum efficiency & the responsivity of the photodiode at 0.85 μm .
- Q.5 (a) Explain the operational principles of WDM & describe the 2×2 fiber coupler. 07
 (b) Explain optical time domain reflectometer and describe the OTDR trace. 07
- OR**
- Q.5 (a) Explain the point to point link in detail & discuss the optical power loss model. 07
 (b) Describe the insertion loss method for optical attenuation measurement. 07
