

GUJARAT TECHNOLOGICAL UNIVERSITY**PDDC - SEMESTER-V • EXAMINATION – SUMMER 2013****Subject Code: X 51102****Date: 14-05-2013****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 a typical optical fiber transmission link showing all major elements. Also list out the advantages of the optical communication system using optical fiber as a transmission link. **07**
- (b) Justify the following statements: **07**
- i) A mode remains guided as long as propagation factor β satisfies the condition $n_2 k < \beta < n_1 k$.
 - ii) Signal distortion mechanism in optical fiber limits the information rate of the signal.
- Q.2** (a) Explain the total internal reflection of ray and numerical aperture with necessary derivation. A point source of light is 12 cm below the surface of a large body of water ($n=1.33$ for water). What is the radius of the largest circle on the water surface through which the light can emerge? **07**
- (b) Answer the following questions: **07**
- i) Compare step index and graded index fibers with respect to: Fiber structure, Core-cladding index difference, and Numerical aperture.
 - ii) A step-index fiber has a 25- μm core radius, a core index of 1.48, and a cladding index of 1.46. At wavelength 820 nm, what is the normalized frequency parameter V , the number of modes guided by the fiber, and the percentage of the optical power flowing in the cladding?
- OR**
- (b) Answer the following questions: **07**
- i) Explain any one technique for the fabrication of optical fiber in brief.
 - ii) An optical signal at a specific wavelength has lost 55 percent of its power after traversing 3.5 km of fiber. What is the attenuation in dB/km of this fiber?
- Q.3** (a) Explain pulse broadening in graded-index fiber. Also explain how graded index profile reduces the dispersion. **07**
- (b) Describe the following: **07**
- i) Scattering losses
 - ii) Group delay with necessary equation
- OR**
- Q.3** (a) Compare LED & LASER. Describe the construction of an edge emitting double-heterojunction LED with labeled sketch. **07**
- (b) Compare spontaneous & stimulated emission. Describe the structure of distributed feedback (DFB) laser diode with neat sketch. **07**

- Q.4** (a) Explain block diagram of optical receiver. **07**
(b) Derive the equation for the power launched from LED source into a step-index fiber. A GaAs optical source with a refractive index of 3.6 is coupled to a silica fiber that has a refractive index of 1.48. If the fiber end and the source are in close physical contact, What is the power loss in decibels from the source into the fiber? **07**

OR

- Q.4** (a) Write short-note on: Rise-time budget **07**
(b) Describe the operation of RAPD. A given silicon avalanche photodiode has a quantum efficiency of 65 percent at a wavelength of 900 nm. Suppose $0.5 \mu\text{W}$ of optical power produces a multiplied photocurrent of $10 \mu\text{A}$, find multiplication M. **07**

- Q.5** (a) Explain Erbium-Doped Fiber Amplifiers (EDFA) with its three possible configurations. **07**
(b) Write brief note on: **07**
i) Fusion splicing of optical fibers
ii) WDM concept

OR

- Q.5** (a) Write detail note on synchronous optical network (SONET) **07**
(b) Answer the following questions: **07**
i) Explain the experimental setup to measure fiber attenuation using the cutback technique.
ii) Explain basic 2×2 Mach-Zehnder interferometer.
