

GUJARAT TECHNOLOGICAL UNIVERSITY**M. E. IST Semester–Remedial Examination – July- 2011****Subject code: 710405N****Subject Name: Fiber Optic Communication****Date:12/07/2011****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) Draw the block diagram of optical fiber transmission link and explain the function of each element in detail. **07**
- (b) Define:(1)angle of incidence **07**
(2)total internal reflection
(3) critical angle
(4) plane of incidence
(5) External reflection
(6) internal reflection
(7) Snell's law

- Q.2** (a) Explain the advantages of optical fiber communication in detail. **07**
- (b) With figure explain double crucible arrangement for drawing fibers from molten glass. **07**

OR

- (b) With neat diagram explain the outside vapor-phase oxidation (OVPO) process of fiber fabrication. **07**
- Q.3** (a) Explain intramodal dispersion in detail **07**
- (b) A 6 km optical link consists of multimode step index fiber with a core refractive index of 1.5 and a relative refractive index 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) Explain the three key transition processes involved in laser action. **07**
- (b) Draw and explain the schematic of a high-radiance surface emitting LED. **07**
- Q.4** (a) Draw and explain the schematic of an edge-emitting double heterojunction LED. **07**
- (b) The radiative and nonradiative recombination lifetimes of minority carriers in the active region of a heterojunction LED are 60 ns and 100 ns respectively. Determine the total carrier recombination lifetime and the power internally generated within the device when the peak emission wavelength is 0.87 μm at a drive current of 40 mA. **07**

OR

- Q.4 (a)** A planar LED is fabricated from gallium arsenide which has a refractive index of 3.6 **07**
- (1) Calculate the optical power emitted into air as a percentage of the internal optical power for the device when the transmission factor at the crystal-air interface is 0.68
 - (2) When the optical power generated internally is 50% of the electrical power supplied, determine the external power efficiency.
- (b)** When 3×10^{11} photons each with a wave-length of $0.85 \mu\text{m}$ are incident on a photo diode, on average 1.2×10^{11} electrons are collected at the terminals of the device. Determine the quantum efficiency and the responsivity of the photo diode at $0.85 \mu\text{m}$ **07**
- Q.5 (a)** With neat diagram explain the working of p-n photo diode. **07**
- (b)** A photo diode has a quantum efficiency of 65% when photons of energy $1.5 \times 10^{-19} \text{ J}$ are incident upon it **07**
- (1) At what wave length is the photo diode operating?
 - (2) Calculate the incident optical power required to obtain a photo current of $2.5 \mu\text{A}$ when the photo diode is operating as described above.
- OR**
- Q.5 (a)** With diagram explain Optical Time Domain Reflectometry(OTDR) or the back scatter measurement method in detail. **07**
- (b)** A graded index fiber with a parabolic refractive index profile core has a refractive index at the core axis of 1.5 and a relative index difference of 1%. Estimate the maximum possible core diameter which allows single-mode operation at a wavelength of $1.3 \mu\text{m}$. **07**
