M.Sc. 3rd Semester Examination, 2012

ELECTRONICS

(*Optical Communication and Information Processing*)

PAPER—ELC-304

[Theory]

Full Marks : 50

Time : 2 hours

Answer **Q. No. 1** and any **three** questions from the rest

The figures in the right-hand margin indicate marks

Candidates are required to give their answers in their own words as far as practicable

Illustrate the answers wherever necessary

1. (*a*) Give a simple explanation for bend loss in optical fiber transmission.

   (*b*) The refractive indices of the core and cladding of a step fiber are 1·485 and 1·465 respectively. Light of $\lambda = 0.85 \, \mu m$ is guided through it. Calculate the minimum and maximum values of the propagation constant β.

(c) Explain the optical logic used in achieving AND gate.

(d) Why the information carrying capacity is increased if light wave is used as carrier ?

(e) Why Si is not used as a optical source for LED or Laser diode ? 2×5

2. (a) Explain the refractive index distribution

$$n^2(r) = n_1^2 \left[1 - 2\delta \left(\frac{r}{a} \right)^q \right], \ r < a$$
$$= n_1^2 [1 - 2\delta], \qquad r > a$$

for a graded index fiber with reference to symbols. Sketch and name the profiles with justification for $q = 1, 2$ on ∞.

(b) Explain the possible misalignment losses in fibre-to-fibre splicing of optical fiber. $(3 + 3) + 4$

3. Why do you drive a LED under forward bias in order to get light emission from the same ? What are the impurity related transition processes in an LED and how do they help in improving the quantum efficiency of the device ? Discuss a practical LED that uses this process. $2 + 5 + 3$

(*Continued*)

4. (a) Explain briefly with suitable diagrams the principle and importance of optical directional coupler. What is coupling length ?

   (b) Explain how one can achieve less dispersion by using graded index fiber in comparison to step index fiber. $(4 + 2) + 4$

5. (a) Show that one cannot achieve steady state population inversion between just two levels of a 2-level atomic system.

   (b) What is the ultimate line width of a laser determined by ?

   (c) What is the necessity of having open resonators in a laser system ? What is the advantage of having curved mirrors than plane mirrors in a resonator ? $4 + 2 + 4$

6. Write short notes on any *two* of the following : 10

   (i) Multiplexing and demultiplexing of signal
   (ii) LIDAR
   (iii) Pulse coding principle

   [*Internal Assessment* : 10 Marks]