PG/IIS/ELC-201/13

# M.Sc. 2nd Semester Examination, 2013

## ELECTRONICS

( *Applied Optics and Opto Electronics* )

( Theory )

PAPER—ELC - 201

*Full Marks* : 50

*Time* : 2 hours

Answer **Q. No. 1** and any **three** 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.** Answer the following questions : 2 × 5

(*a*) What is Kerr effect ?

(*b*) Explain volume hologram.

(*c*) What are the advantages of four level laser system over three level laser system ?

(*d*) Define Quantum efficiency of a photodiode.

(*e*) Draw the light-current characteristics of LED.

2. Discuss the different vibrational modes of $CO_2$. Explain with diagram the operation of $CO_2$ laser. What does $N_2$ plays role in $CO_2$ laser ? 3 + 5 + 2

3. (*a*) What is numerical aperture ? Derive the expression for numerical aperture and explain its significance. 1 + 5 + 1

(*b*) Consider a fiber with $n_1 = 1{\cdot}48$, $N_2 = 1{\cdot}46$, and with its end placed in water ($n_0 = 1{\cdot}33$). What is the maximum angle of incidence for guidance ? 3

4. What do you mean by waveguide dispersion in an optical fiber ? Derive the expression for waveguide dispersion. 2 + 8

5. How can a semiconductor material be chosen for LED to work in the visible range ? Give example of such a material. State the differences between LED and ILD based on structure, operating principle and output. 3 + 1 + 6

6. (*a*) Sketch the lowest two modes in an optical fiber. How the pulse-broading in an optical fiber can reduced ? 3 + 3

(*b*) Show mathematically how second harmonic is generated due to non-linearity and give an application of it. 3 + 1

[ *Internal Assessment* : 10 Marks]