M.Sc. 2nd Semester Examination, 2010

ELECTRONICS

(*Applied Optics and Optoelectronics*)

PAPER—EL-1201

(Theory)

Full Marks : 40

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 any *five* questions : 2×5

(*a*) Distinguish between multimode and single mode fiber in terms of *v* number and other factors.

(*b*) Explain the weakly guiding approximation.

(*c*) What is the role of optical pumping in lasers ?

(*d*) Why Si is not used for making lasers and LEDs ?

(*e*) Define Quantum efficiency and Responsibility of a photodiode.

(*f*) Distinguish between transmission and reflection holograms.

2. How (*a*) population inversion (*b*) amplification and (*c*) narrow spectral width are achieved in a semiconductor laser ? Show that the light output from a semiconductor is proportional to the driving current. 2 + 2 + 2 + 4

3. (*a*) What do you mean by Q-factor of a laser resonator and Q-switching ?

(*b*) Explain briefly the conditions to achieve Q-switching.

(*c*) Explain briefly the electro-optic technique for successful Q-switching. 2 + 2 + 3 + 3

4. Obtain an expression for numerical aperture of an optical fiber and discuss its significance. Between single mode and multimode fiber, which has low numerical aperture and why ? Consider a bare fiber consisting of a core of refractive index 1·48 and having air ($n_2 = 1$) as cladding. What is its NA ? What is the maximum incident angle up to which light can be guided ? $4 + 1 + 2 + 1 + 2$

5. What do you mean by Holography ? What are the difference between Holography and photography ? Discuss with necessary diagrams the recording of a Hologram. $2 + 3 + 5$

6. Write short notes on any *two* of the following topics : 5×2

   (*i*) CO_2 laser

   (*ii*) Avalanche photodiode

   (*iii*) 2nd and 4th harmonic generation in nonlinear optics.

   (*iv*) Four level laser —its operation and importance.