PG/IIS/ELC-201/12

M.Sc. 2nd Semester Examination, 2012

ELECTRONICS

(*Applied Optics and Optoelectronics*)

(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 do you mean by photo detector ?

(*b*) Explain Pockel's effect.

(*c*) What is meta-stable state ?

(*d*) Why coherent light is essential in Holography ?

(*e*) What is material Dispersion ?

2. What do you mean by *Q*-switching ? What is active *Q*-switching and passive *Q* -switching ? Explain with diagram the rotating reflector method using mechanical shutters technique of successful *Q*-switching. 1 + 3 + 6

3. (*a*) Explain with diagrams the operation of a *p-i-n* photodiode. What are the advantages of *p-i-n* photodiode over *p - n* junction photodiode ?

(*b*) A photodiode has a quantum efficiency of 65 percent when photons of energy $1{\cdot}5 \times 10^{-19}$ J are incident on it. (*i*) calculate the wavelength at which the photodiode is operating and (*ii*) incident optical power required when the current through the diode is 3 μA. (5 + 2) + 3

4. (*a*) What do you mean by multipath dispersion in a step index optical fiber ? Derive the expression for multipath dispersion.

(*b*) The core of a 5 km long optical fiber is made of glass of refractive index 1·55 and the clad is made with another glass of refractive index 1·51. The launching of light is done from air of refractive index 1·0. Determine (*i*) numerical aperture (*ii*) acceptance angle and (*iii*) Intermodal dispersion. (2 + 5) + 3

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

6. (*a*) Consider an optical fiber having $n_{core} = 1{\cdot}53$ and $n_{CLAD} \simeq 1{\cdot}50$, and $\lambda_0 = 1$ μm. If the core radius is 50 μm, then calculate (*i*) V, and (*ii*) number of modes that it can support, (*iii*) maximum radius that can support single mode operation.

(*b*) It is desired to make a silicon pin photodiode of area 1 mm^2 with as fast a response time as possible when used in conjugation with a 50Ω load resistor. Estimate the thickness of the intrinsic region required. Take $\epsilon_r = 11{\cdot}8$ and $v_s = 10^5 ms^{-1}$. (2 + 2 + 2) + 4

[*Internal Assessment* – 10 Marks]