K16P 0209

Reg. No. : .....

Name : .....

Fourth Semester M.Sc. Degree (Regular/Supplementary/Improvement) Examination, March 2016
PHYSICS (2014 Admn.)
PHY 4E06 : Optoelectronics

Time : 3 Hours Max. Marks : 60

SECTION – A

Answer **both** questions (either **a** or **b**).

1. a) Discuss the depletion layer capacitance of a pn junction. Show that the indirect band gap semiconductor recombination life time is inversely proportional to the injected carrier concentration.

   OR

   b) What is Q switching ? What are the conditions required for Q switching ? Explain the different methods for producing Q switching within a laser cavity.

2. a) Explain with necessary diagrams the principle and working of photodiode. Explain it with energy band diagrams and photo detection modes.

   OR

   b) What is electro optic effect ? Explain with the aid of schematic diagram how this effect is used
   a) for phase modulation b) for amplitude modulation. **(2×12=24)**

SECTION – B

Answer **any four**. **1** mark for part **a**, **3** marks for part **b**, **5** marks for part **c**.

3. a) What is meant by non degenerate semiconductor ?
   b) Explain hetrojunction LED with the help of energy band diagram.
   c) For a silicon sample at 300 K, the hole concentration is 4×10^{18} m^{-3} and intrinsic carrier concentration is 1.5×10^{16} m^{-3}. Determine the electron density.

P.T.O.

4. a) What is mode locking ?
   b) Explain any two techniques for producing mode locking.
   c) Compute the mode locked pulse width and the separation between pulses for a dye laser operating over its entire gain band width (570-640 nm) with the cavity mirrors separated by 2 m. The index of refraction is 1.4.
5. a) What is a pin photo diode ?
   b) Discuss the characteristics of a pin photo diode with its energy band diagram.
   c) When a radiation of power 0.126 μW is incident on a pin photo diode, it generates a photo current of 56.6 nA. What is the responsivity and external quantum efficiency of the diode at 700 nm.
6. a) What is a solar cell ?
   b) Draw the equivalent circuit of a solar cell and explain the effective resistance.
   c) A solar cell of area 1 cm^2 is illuminated with light of intensity 900 Wm^{-2}. If the current is –31.5 mA and voltage is 0.505 V in the photovoltaic circuit, what is the efficiency of the solar cell ?
7. a) What is Birefringence ?
   b) Explain the working of a half wave plate.
   c) Calculate the thickness of a half wave plate made of quartz and to be used with sodium light of wave length 589.3 nm. It is given that the principal refractive indices n_e and n_o for quartz are 1.553 and 1.544 respectively.
8. a) What is optical Kerr effect ?
   b) Obtain the condition for ideal phase matching.
   c) Explain the methods for achieving phase matching. **(4×9=36)**