(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 199202   Roll No. [ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]

B.Tech.
(SEM. II) THEORY EXAMINATION 2013-14
ENGG. PHYSICS –II (C)
For CS/IT etc. Group

Time : 3 Hours   Total Marks : 80

SECTION—A

1. Attempt **all** parts of this question. Each part carries 2 marks.

$(2 \times 8 = 16)$

 (a) What are de-Broglie's matter waves ?

 (b) What is the difference between phase velocity and group velocity in wave motion ?

 (c) Explain penetration depth in superconductors.

 (d) What are multi-walled carbon nano tubes ?

 (e) What is hysteresis ? What does the area of hysteresis curve represent ?

 (f) How dielectric constant depends on frequency ?

 (g) Define Hall Effect ? What is the effect of temperature on Hall coefficient ?

 (h) What is image processing ? What do you mean by magnetic tape storage device ?

SECTION—B

2. Attempt any **three** parts of this question. Each part carries 8 marks. (8×3=24)

   (a) An electron has de-Broglie wavelength 2.0×10^{-12} m. Find its kinetic energy. Also find the phase and group velocities of its de-Broglie waves.

   (b) A superconducting material has a critical temperature of 3.7 K in zero magnetic field of 0.306 Tesla at 0 K. Find the critical field at 2 K.

   (c) The dielectric constant of helium at 0°C and 1 atmospheric pressure is 1.000074. Find the dipole moment induced in helium atom when the gas is in an electric field of intensity 100 V/m. Number of atoms per unit volume of helium gas are 2.68×10^{27}.

   (d) In an n-type semiconductor, the Fermi level is 0.3 eV below the conduction band at 300 K. If the temperature is increased to 330 K, find the new position of Fermi level.

   (e) A particle confined to move along X-axis has the wave function $\psi = ax$ between $x = 0$ and $x = 1$ and $\psi = 0$ elsewhere. Find probability that the particle can be found between $x = 0.35$ to $x = 0.45$.

SECTION—C

Note :— Attempt any **one** part of all the questions of this Section. Each question carries 8 marks. (8×5=40)

3. (a) What is Heisenberg's uncertainty principle ? Using this principle explain non-existence of electrons in the nucleus.

   (b) Derive Schrodinger time independent and time dependent equations for matter waves.

4. (a) What are Type I and Type II superconductors ? Distinguish between the two types of semiconductors.

(b) What are buckyballs ? How can the buckyballs be created ? Where are these buckyballs used ?

5. (a) Derive Claussius-Mossotti relation in dielectrics subjected to static field.

(b) Discuss the Langevin's theory for diamagnetic and paramagnetic materials.

6. (a) What do you understand by photovoltaic effect ? Describe the working of a solar cell with suitable diagrams. Also give applications of solar cells.

(b) What is meant by Fermi-Dirac probability distribution function ? Plot the Fermi-Dirac probability distribution function $f(E)$ versus E at 0 K and 2500 K. What do these plots signify ?

7. (a) What is a spatial light modulator ? Explain the working of liquid spatial light modulator.

(b) What is quantum computing ? Explain the difference between classical and quantum computing.

Physical Constants :

Mass of electron	$m_e = 9.1 \times 10^{-31}$ kg
Speed of Light	$c = 3 \times 10^8$ m/s
Planck's constant	$h = 6.63 \times 10^{-34}$ J-s
Mass of Proton	$m_p = 1.67 \times 10^{-27}$ kg
Permeability of free space	$\mu_0 = 4\pi \times 10^{-7}$ H/m
Permittivity of free space	$\varepsilon_0 = 8.854 \times 10^{-12}$ F/m
Avogadro's number	$N = 6.023 \times 10^{23}$ per mole