

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

PAPER ID : 199202

Roll No.

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B.Tech.

(SEM. II) THEORY EXAMINATION 2013-14

ENGG. PHYSICS –II (C)**For CS/IT etc. Group***Time : 3 Hours**Total Marks : 80***Note :-** Attempt questions from each Section as per instructions.**SECTION—A**1. Attempt **all** parts of this question. Each part carries 2 marks.**(2×8=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 $2.0 \times 10^{-12} \text{m}$. 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 superconductors.
- (b) What are buckyballs ? How can the buckyballs be created ? Where are these buckyballs used ?
5. (a) Derive Clausius-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	$m_e = 9.1 \times 10^{-31} \text{ kg}$
Speed of Light	$c = 3 \times 10^8 \text{ m/s}$
Planck's constant	$h = 6.63 \times 10^{-34} \text{ J-s}$
Mass of Proton	$m_p = 1.67 \times 10^{-27} \text{ kg}$
Permeability of free space	$\mu_0 = 4\pi \times 10^{-7} \text{ H/m}$
Permittivity of free space	$\epsilon_0 = 8.854 \times 10^{-12} \text{ F/m}$
Avogadro's number	$N = 6.023 \times 10^{23} \text{ per mole}$