

(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)**

- 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.
- 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.
- 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} .
- 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.
- 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)**

- What is Heisenberg's uncertainty principle? Using this principle explain non-existence of electrons in the nucleus.
 - Derive Schrodinger time independent and time dependent equations for matter waves.

- What are Type I and Type II superconductors? Distinguish between the two types of superconductors.
 - What are buckyballs? How can the buckyballs be created? Where are these buckyballs used?
- Derive Clausius-Mossotti relation in dielectrics subjected to static field.
 - Discuss the Langevin's theory for diamagnetic and paramagnetic materials.
- What do you understand by photovoltaic effect? Describe the working of a solar cell with suitable diagrams. Also give applications of solar cells.
 - 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?
- What is a spatial light modulator? Explain the working of liquid spatial light modulator.
 - 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	$\epsilon_0 = 8.854 \times 10^{-12}$ F/m
Avogadro's number	$N = 6.023 \times 10^{23}$ per mole