

(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**

**For Electrical and Electronics Groups etc.**

*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 ?
- (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) How splices and connectors are used in optical fibres ?

### 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  $2.0 \times 10^{-12}$  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  $0^\circ\text{C}$  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  $2.68 \times 10^{27}$ .
  - (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 at 330 K. Find the new position of Fermi level.
  - (e) Calculate the mean free path of the molecules of a gas in a chamber of  $10^{-6}$  mm of mercury pressure, assuming the molecular diameter to be  $2 \text{ \AA}$ . Take the temperature of the chamber to be 273 K and Boltzmann constant  $k = 1.38 \times 10^{-23}$  J/K.

### SECTION—C

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

3. (a) What is Heisenberg's uncertainty principle ? State and explain any two applications of the principle.
- (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 diagram. Also give applications of solar cells.
- (b) Discuss the theory of Joule-Thomson expansion. Describe the adiabatic demagnetization.
7. (a) Explain the construction and working of pin photodiode and avalanche photodiode with neat diagrams.
- (b) Explain the generation of high pressure using hydraulic system and using diamond anvil system.

**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	$N = 6.023 \times 10^{23} \text{ per mole}$