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 2.0×10^{-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 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 Å. 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 Schrondinger 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	$m_e = 9.1 \times 10^{-31}$ 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