



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

**PAPER ID : 199241**

Roll No.

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## B. Tech.

(SEM. II) THEORY EXAMINATION, 2014-15

ENGINEERING PHYSICS-II (E)

(For (EE/EC 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. 2×8=16

Each part carries 2 marks.

- (a) What do you mean by phase velocity and group velocity?
- (b) Explain Heisenberg's uncertainty principle.
- (c) Distinguish between Type-I and Type-II superconductors.
- (d) What are buckyballs?

- (e) What are the properties of diamagnetic materials?
- (f) What is dielectric loss?
- (g) What do you mean by Hall Effect ?
- (h) How splices and connectors are used in optical fibers?

### SECTION - B

**2** Attempt any three parts of this question.  $8 \times 3 = 24$   
Each part carries 8 marks.

- (a) Find the de-Broglie wavelength of a neutron of energy 12.8 MeV. Given mass of neutron is  $1.675 \times 10^{-27}$  kg.
- (b) The critical field for niobium is  $1 \times 10^5$  A/m at 8K and  $2 \times 10^5$  A/m at 0K. Calculate the transition temperature of the element.
- (c) An iron rod of volume  $10^{-3} \text{ m}^3$  and relative permeability 1200 is placed inside a long solenoid wound with 5 turns per cm. If a current of 0.5 amp is passed through the solenoid, find the magnetic moment of the rod.

- (d) At what temperature can we expect a 10% probability that electrons in a metal will have an energy which is 1% above  $E_F$ . The Fermi energy of the metal is 5.5 eV.
- (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

$$k = 1.38 \times 10^{-23} \text{ J/K.}$$

### SECTION - C

Attempt any one part of all the questions of  $8 \times 5 = 40$  this section. Each question carries 8 marks.

- 3** (a) What are matter waves? Describe Davisson and Germer experiment for the study of electron diffraction and prove that electrons possess wave nature.

- (b) Find an expression for the energy states of a particle in a one –dimensional box. Also calculate the normalized wave function.
- 4 (a) How are Cooper pairs formed? Explain the BCS theory of superconductor.
- (b) What are carbon nanotubes? Describe a method for synthesis of carbon nanotubes.
- 5 (a) What do you mean by polarization in dielectrics? Explain different types of polarization and their mechanism.
- (b) What is meant by Hysteresis? Explain hysteresis loss. Prove that the area of the B-H curve is equal to the hysteresis loss per unit volume of the specimen in one cycle.
- 6 (a) What is a solar cell? Describe its working with suitable diagram.
- (b) What do you mean by adiabatic demagnetization? Describe the mechanism of cooling by adiabatic demagnetization.

- 7 (a) What do you mean by pin and avalanche photodiode? Explain the construction and working of avalanche photodiode with neat diagrams.
- (b) Describe the working of diffusion pump for producing low pressures. How are these low pressures measured?

**Physical Constants:**

Mass of electron	$m_e = 9.1 \times 10^{-31} \text{ kg}$
Speed of Light	$c = 3 \times 10^8 \text{ m/s}$
Plank'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	$N = 6.023 \times 10^{23} \text{ per mole}$