

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

PAPER ID : 1213

Roll No.

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**B. Tech.**

(For CS/IT)

**(Semester II) Even Semester Theory Examination, 2012-13****ENGINEERING PHYSICS-II(C)****Time : 3 Hours]****[Total Marks : 80****Note :** Attempt questions from each Section as per instructions.**Section-A**Attempt *all* parts of this question. Each part carries 2 marks. 2×8=16

1. (a) What do you understand by wave packet?
- (b) Explain, why electron can not reside inside nucleus?
- (c) What is Meissner effect?
- (d) What is dielectric loss?
- (e) What do you mean by coercivity?
- (f) What is the importance of Hall effect?
- (g) Explain the photovoltaic effect.
- (h) What is image processing?

**Section-B**Attempt any *three* parts of this question. Each part carries 8 marks. 8×3=24

2. (a) Calculate the de-Broglie wavelength associated with a proton moving with a velocity equal to one twentieth of the velocity of light.
- (b) The critical fields at 6K and 8K for NbTi alloys are 7.616 and 4.284 MA/m respectively. Calculate the transition temperature and the critical field at 0 K.
- (c) Calculate the electronic polarizability of argon atom, at NTP, the dielectric constant of argon is 1.0024 and its atomic density is  $2.7 \times 10^{25}$  atoms/m<sup>3</sup>.
- (d) An iron rod 20 cm long, 1cm in diameter and of a permeability 1,000 is placed inside a solenoid, 1 meter long wound uniformly with 600 turns . If the current of 0.5 ampere is passed through the solenoid, find the magnetic moment of the rod.
- (e) There are about  $2.5 \times 10^{28}$  free electrons/m<sup>3</sup> in sodium. Calculate its Fermi energy, Fermi velocity and Fermi temperature.

### Section-C

Attempt *all* questions of this Section. Each question carries 8 marks. 8×5=40

3. Attempt any one part of the following :
- What are phase and group velocity? Establish a relation between them in terms of frequency.
  - A particle is moving along a line between  $x=0$  and  $x=a$  with zero potential energy. At point for which  $x < 0$  and  $x > a$ , the potential energy is infinite. Solving Schrödinger's equation, obtain the energy, eigenvalues and the normalized wave function for the particle.
4. Attempt any one part of the following :
- What do you mean by superconductivity? Explain the BCS theory of superconductors and give some applications of superconductors.
  - What are non-omaterials? Discuss preparation technique and properties of Buckyball.
5. Attempt any one part of the following :
- Discuss frequency dependence of dielectric constant. What is relaxation time?
  - What is diamagnetism? Show that susceptibility of diamagnetic material is negative and independent of temperature.
6. Attempt any one part of the following :
- What is Fermi energy? Show how this energy depends on the density of electron gas.
  - What is Hall effect? Derive a relation between mobility and Hall coefficient.
7. Attempt any one part of the following :
- Discuss the discrete Fourier transform and explain spatial filtering.
  - Explain the principle of holography. How this technique is useful to store the information.

#### Physical constants :

Speed of light	$c = 3.0 \times 10^8$ m/s
Planck's constant	$h = 6.62 \times 10^{-34}$ J-s
Mass of electron	$m = 9.1 \times 10^{-31}$ kg
Mass of proton	$m_p = 1.67 \times 10^{-27}$ kg
Permeability	$\mu_0 = 4 \pi \times 10^{-7}$ H/m
Permittivity	$\epsilon_0 = 8.854 \times 10^{-12}$ F/m