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Question Paper Code : 24086

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2018.

Second Semester

Civil Engineering

PH 2161 — ENGINEERING PHYSICS – II

(Common to all Branches)

(Regulations 2008)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Give the statement of Wiedemann-Franz law.

2. Mention two drawbacks of classical free electron theory of metals.

3. Find the resistance of an intrinsic Ge rod 1 cm long, 1 mm wide, and 0.5 mm thick at 300 K. For Ge, $n_i = 2.5 \times 10^{19}/m^3$, $\mu_e = 0.39\ m^2\ v^{-1}\ s^{-1}$ and $\mu_p = 0.19\ m^2\ v^{-1}\ s^{-1}$, at 300 K.

4. Given an extrinsic semiconductor, how will you find whether it is n-type or p-type.

5. The magnetic field strength of silicon is 1500 Am^{-1}. If the magnetic susceptibility is $-(0.3 \times 10^{-5})$. Calculate the magnetisation and flux density is silicon.

6. What is meant by persistent current?

7. Define dielectric constant.

8. Distinguish between dielectric loss and dielectric breakdown.

9. Mention some of the applications of shape memory alloys.

10. Write any four properties of Nanomaterials.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Obtain Wiedemann Franz law using the expressions of electrical and thermal conductivity and find the expression for Lorentz number. (6)

(ii) The density of Silver is 10.5×10^3 kg/m^3. The atomic weight of silver is 107.9. Each silver atom provides one conduction electron. The conductivity of silver at 20°C is 6.8×10^7 ohm^{-1} m^{-1}. Calculate the density of electrons and also the mobility of electrons in silver. (5)

(iii) Calculate the electrical and thermal conductivities of a metal with the relaxation time of 10^{-14} second at 300 K. The electron density is 6×10^{26}m^{-3}. (5)

Or

(b) (i) Derive an expression for electrical conductivity based on Quantum theory. (8)

(ii) Write the expression for Fermi distribution function and explain with suitable diagram. How does it vary with temperature? (4)

(iii) Calculate the Fermi energy and Fermi temperature in a metal. The Fermi velocity of electrons in the metal is 0.86×10^6 m/s. (4)

12. (a) (i) What is Fermi level in intrinsic semiconductor? And discuss the variation of Fermi level in intrinsic semiconductor with temperature. (8)

(ii) Derive the expression for electrical conductivity in an intrinsic semiconductor and explain the variation of it with temperature. (8)

Or

(b) (i) How the Fermi level changes its position with the temperature and impurity concentration in N-type semiconductors? (6)

(ii) Define Hall effect in semiconductors. How the Hall coefficient is determined? (10)

13. (a) (i) Explain the domain theory of Ferromagnetism and hence describe the magnetic hysteresis. (10)

(ii) What are Ferrites? Explain magnetic recording and read out mechanisms. (6)

Or

(b) (i) Describe the different properties of superconductors and also explain the classification of super conductors as Type I and Type II superconductors. (10)

(ii) Explain BCS theory of superconductors. (6)

14. (a) (i) Define the following:

(1) Dielectric constant ε_r,

(2) Polarizability, α

(3) Polarization vector, $\vec{P}$

(4) Electric flux density, D .

(5) Electric susceptibility, χ.

Give also the necessary equations relating the above quantities. (12)

(ii) Calculate the electronic polarizability of an argon atom whose $\varepsilon_r = 1.0024$ at NTP and $N = 2.7 \times 10^{25}$ atoms/m^3. (4)

Or

(b) (i) Define 'internal field', Obtain the expression for internal field using Lorentz method and hence deduce the Clausius-Mosotti equation. (2 + 6 + 4)

(ii) The atomic weight and density of sulphur are 32 and 2.08 gm/cm^3 respectively. The electronic polarizability of the atom is 3.28×10^{-40} Fm^2. If sulphur solid has cubic symmetry, what will be the relative permittivity? Take Avogadro number as 6.023×10^{26}, $\varepsilon_0 = 8.86 \times 10^{-12}$ Fm^{-1}. (4)

15. (a) Explain the characteristics of Shape Memory Alloy and mention its advantages and disadvantages. (16)

Or

(b) (i) Describe plasma arcing technique with a diagram to fabricate nano particles. (8)

(ii) Explain how are carbon nano particles fabricated using Laser deposition method. (8)

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