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Question Paper Code : 57700

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2016

Second Semester

Civil Engineering

PH 6251 – ENGINEERING PHYSICS – II

(Common to all branches except Biotechnology and Pharmaceutical Technology)

(Regulations 2013)

Time : Three Hours

Maximum : 100 Marks

Answer ALL questions.

PART – A (10 × 2 = 20 Marks)

1. Distinguish between drift velocity and thermal velocity of an electron.
2. What are the essential features of quantum free electron theory ?
3. What is Hall voltage ? Hall voltage of an extrinsic semiconductor depends on what properties of the material ?
4. The electrical resistivity of certain intrinsic semiconductor is $0.40 \Omega \text{ m}$. The electron and hole mobilities are $0.64 \text{ m}^2 \text{ V}^{-1} \text{ s}^{-1}$ and $0.36 \text{ m}^2 \text{ V}^{-1} \text{ s}^{-1}$ respectively. Calculate the electron and hole densities.
5. What are the properties required for a material to be suitable for making electromagnet ? Give examples.
6. What is London penetration depth ?
7. How does a dielectric material find its application in gas lighters ?

8. Calculate the electronic polarizability for argon atom. Given $\epsilon_r = 1.0024$ at NTP and $N = 2.7 \times 10^{25} \text{m}^{-3}$.
9. Define the term birefringence.
10. What are metallic glasses ? Give two important characteristic properties of these materials.

PART - B (5 × 16 = 80 Marks)

11. (a) (i) Derive the expressions for electrical and thermal conductivities of metals based on classical free electron theory. Discuss how far they were successful in explaining the experimental results. (12)
- (ii) A 5.8 m length and 2.0 mm diameter wire carries a current of 750 mA current, when the applied potential across its ends is 22 mV. If the drift speed of the electrons is 7.2×10^5 m/s, calculate the electrical resistivity of the wire and the conduction electron density of the material of the wire. (4)

OR

- (b) (i) Explain Fermi-Dirac distribution function and discuss its behaviour with respect to temperature. Also represent it graphically. (6)
- (ii) Assuming the expression for density of energy states, find the expression for conduction electron density in metals. How does it change with temperature ? (6)
- (iii) The electrical conductivity of Cu at room temperature is $5.9 \times 10^7 \Omega^{-1} \text{m}^{-1}$. The Fermi energy for Cu is 7.0 eV and the conduction electron density is 8.4×10^{28} electrons m^{-3} . Calculate the Fermi velocity and mean free path of the electrons. (4)

12. (a) Explain the electrical properties of an intrinsic semiconductor based on band theory. Derive an expression for electron density in the conduction band and explain how it changes with temperature. (16)

OR

- (b) Derive an expression for Fermi energy level in a n-type semiconductor. Discuss the variation the Fermi level with temperature along with graphical representation and show that n-type semiconductor behaves as an intrinsic semiconductor at high temperature. (16)
13. (a) (i) Distinguish between hard and soft magnetic materials with their applications. (8)
- (ii) Write a note on ferrites. Give reasons why ferrites are preferred over ferromagnetic materials as core materials for high frequency applications. (8)

OR

- (b) (i) Distinguish between type I and type II superconductors. (8)
- (ii) Explain BCS theory of superconductivity. (4)
- (iii) Explain SQUID. (4)
14. (a) (i) Derive an expression for the Lorentz field developed inside a dielectric material when it is placed in a electric field. (12)
- (ii) Explain any two important dielectric breakdown mechanism. (4)

OR

- (b) (i) Explain the phenomenon of ferroelectricity. Explain the ferroelectric properties exhibited by BaTiO_3 crystal. (12)
- (ii) How does a dielectric material behave when it is placed in a A.C field ? (4)

15. (a) (i) Explain the characteristic properties exhibited by NiTi shape memory alloy. (8)
- (ii) Write a note on NLO materials. (8)

OR

- (b) (i) Explain pulsed laser deposition method of preparing nano materials. What are the advantages of this method compared to other methods? (8)
- (ii) Explain the application of biomaterials in the fields of orthopedics. (8)