Reg. No. | | | | | | | | | | | |

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 Ω m. The electron and hole motilities are 0.64 $m^2 V^{-1} s^{-1}$ and 0.36 $m^2 V^{-1} s^{-1}$ 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 $\varepsilon_r = 1.0024$ at NTP and $N = 2.7 \times 10^{25} m^{-3}$.

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 5.9×10^7 $\Omega^{-1}m^{-1}$. 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)**