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Question Paper Code : 97141

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2014.

Second Semester

Civil Engineering

PH 6251 — ENGINEERING PHYSICS — II

(Common to all branches except Biotechnology and Pharmaceutical Technology)

(Regulation 2013)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. The Fermi energy for silver is 5.1 eV. If the temperature is 300 K, what is the probability that the states with energies 5.0 eV and 5.2 eV be occupied?

2. Calculate the conduction electron density in cesium, if its Fermi energy is 1.55 eV.

3. The energy gap in germanium is 0.67 eV The electron and hole effective masses are 0.12 m_e and 0.23 m_e respectively, where m_e is the free electron mass. Calculate the Fermi energy.

4. What are direct and indirect band gap semiconductors?

5. Define the term Bohr magneton.

6. What is BCS theory of superconductivity?

7. Define the term dielectric breakdown.

8. The polarizability of Krypton atom is 2.18×10^{-40} Fm^2. Calculate its dielectric constant at 0°C and 1 atmosphere. The number of krypton atoms at NIP is $2.69 \times 10^{25} / m^3$.

9. Give any four property changes that can be observed when a bulk material is synthesized as nanomaterial.

10. What are metallic glasses?

PART B — (5 × 16 = 80 marks)

11. (a) What are the basic assumptions of classical free electron theory? Based on the assumptions derive an expression for electrical and thermal conductivity of metals. What are the success and failures of the theory? (2 + 10 + 4)

Or

(b) Explain the concept of density of energy states. Derive an expression for density of energy states, using the expression find an expression for Fermi energy level for metals at 0 K. (2 + 10 + 4)

12. (a) Describe the formation of n-type semiconductor with energy band diagram. Derive an expression for density of charge carriers and explain how the charge carrier density varies with temperature. (2 + 10 + 4)

Or

(b) (i) Explain Hall effect in semiconductors. Derive an expression for Hall co-efficient. Explain how Hall probe is used to detect weak magnetic fields. (2 + 6 + 4)

(ii) A rectangular slab of silicon of thickness 1 mm is placed in the region of the magnetic field perpendicular to the field and the current in the slab is 20 mA, the Hall voltage is 150 μV. The free electron concentration of that particular silicon is 6×10^{24} electrons/m^3. What is the strength of the magnetic field? (4)

13. (a) (i) Explain domain theory of ferromagnetism. (8)

(ii) What is hysteresis? Explain how magnetic materials are classified based on the hysteresis property. (8)

Or

(b) (i) Explain high temperature superconductors with examples. (8)

(ii) Explain the working principle of SQUID and Cryotron. (8)

14. (a) Explain the different types of polarization mechanisms in dielectric materials. Derive an expression for total polarization. (16)

Or

(b) (i) Explain the temperature and frequency dependence of polarization. (8)

(ii) Explain ferroelectric materials. Give its applications. (8)

15. (a) (i) What are shape memory alloys. Explain their properties. (8)

(ii) Write a note on biomaterials and its applications. (8)

Or

(b) (i) What are nanomaterials. Explain any one method of preparing nanomaterials. (8)

(ii) Explain electro-optic and magneto-optic Kerr effect. (8)