Reg. No. : E N G G T R E E . C O M

Question Paper Code : 51506

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2024.

Second Semester

Aeronautical Engineering

PH 3205 — APPLIED PHYSICS

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State Wiedemann – Franz law.
2. Define electron effective mass.
3. Differentiate between direct and indirect bandgap semiconductors.
4. Distinguish between Ohmic contact and Schottky contact.
5. Give a brief note on the static dielectric constant in a material.
6. Where are piezoelectric crystals used?
7. What is the difference between ferromagnetism and ferrimagnetism?
8. Define exchange interaction.
9. Compare group velocity and phase velocity.
10. What is the principle of Luminescence?

PART B — (5 × 16 = 80 marks)

11. (a) List out the basic assumptions of classical free electron theory. Deduce a mathematical expression for electrical conductivity and thermal conductivity of a conducting material.

Or

(b) (i) Write the expression for the Fermi energy distribution function F(E) and discuss its behavior with change in temperature, Plot F(E) versus E for T = 0 K and T > 0 K. (12)

(ii) Use Fermi distribution function to obtain the value of F(E) for $E-E_F = 0.01$ eV at 200 K. (4)

12. (a) (i) Derive the expression for density of electrons in a n-type semiconductor in terms of donor density. (12)

(ii) Explain the differences in the band features of n-type and p-type semiconductors using neat diagrams. (4)

Or

(b) What is Hall effect? Obtain an expression for Hall coefficient. Explain the experimental setup used to find Hall coefficient and give its applications.

13. (a) What are the different types of polarization in dielectric materials? Obtain Langevin-Debye equation for dielectric polarization. Briefly explain the effect of frequency on polarization of dielectrics.

Or

(b) (i) What is meant by local field? Obtain expression for the same and hence derive Clausius – Mossotti equation. (12)

(ii) Explain the ferroelectric behaviour of $BaTiO_3$. (4)

14. (a) (i) Explain the ferromagnetic domain theory in detail and also how you will account for the hysteresis of ferro magnetic material based on domain theory. (12)

(ii) A paramagnetic material has a magnetic field intensity of 10^4 A/m. If the susceptibility of the material at room temperature is 3.7×10^{-3}, calculate the magnetization and flux density in the material. (4)

Or

(b) (i) In detail explain any two properties of superconductor. (4)

(ii) What are Cooper pairs? Give an outline of BCS theory of superconductivity. (8)

(iii) Superconductor Sn has a critical temperature of 3.7 K at zero magnetic filed and a critical field of 0.0306 T at 0 K, Find the critical magnetic field at 2 K. (4)

15. (a) What are Non-Linear Optical Materials? How do non-linear optical materials function? What is phase matching in NLO materials? How it can be achieved?

Or

(b) (i) Explain the principle and working of light emitting diode. (8)

(ii) What is electro optic effect? Explain the working of electro optic modulators and mention its uses. (8)