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

Question Paper Code: 52004

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2022

Second Semester

Electrical and Electronics Engineering

15UPH204 – SOLID STATE PHYSICS

(Common to EIE and Biomedical Engineering)

(Regulation 2015)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. According to ohm's law, the relation between electric field E, conductivity σ and current density J is given as CO1-R

   (a) $J = \sigma / E$ (b) $J = \sigma E$ (c) $J = \sigma E^2$ (d) $J = E / \sigma$

2. Mobility of electrons is defined as CO1-R

   (a) flow of electrons per unit electric field

   (b) average electron drift velocity per unit electric field

   (c) inverse of conductivity

   (d) the product of drift velocity and electric field

3. The direction of Hall voltage is CO2-R

   (a) parallel to applied electric field

   (b) perpendicular to applied magnetic field only

   (c) perpendicular to applied electric field only

   (d) perpendicular to both applied electric and magnetic field

4. Donor type impurities are the CO2-R

   (a) trivalent atoms (b) tetravalent atoms

   (c) pentavalent atoms (d) divalent atoms

5. Transformer cores are made of materials having CO3-R

(a) low hysteresis loss (b) high hysteresis loss

(c) low permeability (d) low specific resistance

6. Meissner effect is strictly followed by CO3-R

(a) Ferromagnetic material (b) paramagnetic material

(c) conducting material (d) superconducting material

7. Orientational polarization CO4-R

(a) increases with temperature

(b) decreases with temperature

(c) independent of temperature

(d) first increases and then decreases with temperature

8. Ceramic materials are CO4-R

(a) hard (b) brittle (c) both (a) and (b) (d) ductile

9. Nano indicates CO5-R

(a) 10^{-15} m (b) 10^{-12} m (c) 10^{-6} m (d) 10^{-9} m

10. Which one of the following is a top down process of synthesizing nanoparticle? CO5-R

(a) ball milling method (b) Sol – gel method

(c) Colloidal method (d) Electrodeposition method

PART – B (5 x 2= 10Marks)

11. State Wiedemann Franz law. CO1-R

12. Mention any two applications of Hall effect. CO2-R

13. What are ferrites? CO3-R

14. Define electrical susceptibility. CO4-R

15. Give any two properties of nanoparticles. CO5-R

PART – C (5 x 16= 80Marks)

16. (a) Obtain an expression for electrical conductivity for metals on the basis of classical free electron theory and calculate electrical conductivity of a metal with relaxation time 10^{-14} second and density of electrons 6×10^{28} m^{-3} by CO1-App (16)

Or

	(b)	Calculate carrier concentration in metals by deriving an expression for density of energy states in metals.	CO1-App	(16)
17.	(a)	(i) Distinguish between direct and indirect band gap semiconductor.	CO2-U	(8)
		(ii) What are the differences between intrinsic and extrinsic semiconductors?	CO2-U	(8)
		Or		
	(b)	(i) Obtain the expression of Hall coefficient in terms of current density and electronic charge by defining Hall effect.	CO2-U	(8)
		(ii) How will you identify whether the given semiconductor is a p-type or n-type semiconductor?	CO2-U	(8)
18.	(a)	Distinguish between diamagnetic, paramagnetic and ferromagnetic magnetic materials.	CO3-U	(16)
		Or		
	(b)	(i) Distinguish between Type I and Type II super conductors.	CO3-U	(8)
		(ii) Distinguish between hard and soft magnetic materials.	CO3-U	(8)
19.	(a)	Explain the electronic, ionic, orientational and space charge polarization in dielectrics.	CO4-U	(16)
		Or		
	(b)	Obtain an expression for the internal field experienced by an atom in a one dimensional array of atoms subjected to an external field and deduce Clausius – Mosotti equation. Using the above Clausius Mosotti equation , calculate the dielectric constant of the material for a solid elemental dielectric with density 3×10^{28} atoms / m^3 having electronic polarisability 2×10^{-40} Fm^2.	CO4-U	(16)
20.	(a)	Explain any one method of top down approach of synthesizing nanomaterial in detail.	CO5-U	(16)
		Or		
	(b)	.Explain the properties and applications of nano materials.	CO5-U	(16)