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

Question Paper Code: 52004

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2024

Second Semester

Electrical and Electronics Engineering

15UPH204 – SOLID STATE PHYSICS

(Common to Biomedical Engineering)

(Regulation 2015)

Duration: Three hours Maximum: 100 Marks

PART A - (10 x 1 = 10 Marks)

1. The electrical conductivity of a conductor may be increased by CO1- R

   (a) Increasing its temperature (b) decreasing its temperature

   (c) Increasing its vibrations (d) Decreasing its mobility

2. In classical free electron theory, electrons constitute electron gas, obeying _____ under the equilibrium condition. CO1 -R

   (a)Maxwell– Boltzmann statistics (b) Bose Einsteins statistics

   (c) Fermi Dirac statistics (d) Zone theory

3. Conductivity of a semiconductor increases with CO2 -R

   (a) increase in temperature (b) decrease in temperature

   (c) constant temperature (d) increase in band gap

4. At O K, a semiconductor acts CO2- R

   (a) as a superconductor (b) a good conductor

   (c) as an insulator (d) same as semiconductor

5. Water is a _____ substance. CO3 -R

   (a) paramagnetic (b) ferromagnetic

   (c) diamagnetic (d) anti ferro magnetic

6. The structure of High temperature superconductor is… CO3 -R

(a) cubic (b) FCC (c) BCC (d) pervoskite

7. Ionic polarization CO4- R

(a) decreases with increase in temperature

(b) is independent of temperature

(c) increases with temperature

(d) first increases and then decreases with temperature

8. Permittivity of free space is CO4 -R

(a) 8.854×10^{-12} F/m (b) 7.854×10^{-12} F/m

(c) 9×10^{9} F/m (d) 6.625×10^{-24} F/m

9. The versatility of nanotechnology is due to CO5 R

(a) low density ratio (b) high surface to volume ratio

(c) low surface to volume ratio (d) high density ratio

10. The approach used to construct nano materials by merging smaller components into more complex assemblies is CO5 -R

(a) Top-down approach (b) Bottom-up approach

(c) bottom-bottom approach (d) Top-top approach.

PART – B (5 x 2= 10Marks)

11. Mention any two postulates of classical free electron theory CO1 -R

12. Distinguish between elemental and compound semiconductors. CO2- R

13. Write note on High Temperature Super Conductors (HTSC). CO3- R

14. Mention any two properties of ceramics. CO4- R

15. Mention the applications of nano materials in electronics. CO5- R

PART – C (5 x 16= 80Marks)

16. (a) On the basis of free electron theory derive an expression for the thermal and electrical Conductivity and Explain Lorentz number CO1 -App (16)

Or

(b) (i) Define density of energy states in metals. Calculate carrier concentration in metals by deriving an expression for density of states. CO1 -App (10)

(ii) Obtain an expression for Fermi energy in terms of carrier concentration in metals. CO1 -U (6)

17.	(a)	(i) What is Hall effect? Obtain the expression for Hall coefficient in terms of current density and electronic charge.	CO2 -App	(8)
		(ii) Hall coefficient of certain silicon specimen was found to be -7.35×10^{-5} m^3C^{-1}. Determine the nature of the semiconductor, if the conductivity was 200 $\Omega^{-1}m^{-1}$. Calculate the density and mobility of the charge carriers	CO2 -App	(8)
		Or		
	(b)	Explain with neat sketch the P-type extrinsic semiconductor. Derive an expression for concentration of carrier in an extrinsic Semiconductor	CO2 -Ana	(16)
18.	(a)	Explain domain theory of ferromagnetism.	CO3 -Ana	(16)
		Or		
	(b)	Show that superconductors are perfect diamagnet. Differentiate type I and type II superconductor. Why do we prefer Type II superconductors for making permanent magnets?	CO3 -Ana	(16)
19.	(a)	(i) What is meant by internal field in dielectrics? Obtain an expression for internal field experienced by an atom in a cubic structure using Lorentz method.	CO4 -U	(8)
		(ii) Assume ε_r as dielectric constant of the material and α_e as electronic polarisability, deduce Clausius Mosotti relation using the expression obtained above for internal field.	CO4- U	(8)
		Or		
	(b)	Explain the various methods of processing in ceramics	CO4 -Ana	(16)
20.	(a)	Discuss the techniques of synthesis of Nano materials using Ball milling and Chemical Vapour Deposition method	CO5- U	(16)
		Or		
	(b)	(i) Explain the variation of nano material's property with its geometry..	CO5 -U	(12)
		(ii) Mention the applications of nanomaterials.	CO5 -U	(4)

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