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

Question Paper Code: R2P03

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

Second Semester

Civil Engineering

R21UPH203 - MATERIAL PHYSICS

(Regulations R2021)

(Common to Mechanical, Agricultural & Chemical Engineering branches)

Duration: Three hours | Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. Copper has FCC structure and its atomic radius is 1.273×10^{-10} m. Find the lattice parameter. CO1-U

   (a) 4.26×10^{-10}m (b) 4.28×10^{-10}m (c) 5.33×10^{-10}m (d) 3.6×10^{-10}m

2. A particular metal has a simple cubic unit cell. How many atoms of the metal are in each unit cell? CO1-U

   (a) 1 (b) 4 (c) 6 (d) 2

3. The main principle used in interference is CO2-U

   (a) Heisenberg's uncertainty principle

   (b) Superposition Principle of wave

   (c) Quantum mechanics

   (d) Fermi principle

4. Which of the following is the unique property of laser CO2-U

   (a) Monochromotic (b) Directionality (c) Coherence (d) All of them

5. Choose the least thermal conductivity from the following? CO1-U

   (a) Air (b) Diamond (c) Water (d) Iron

6. Thermal conductivity is the rate of heat transfer CO1-U

(a) Per unit area per unit thickness

(b) Per unit area per unit temperature difference and per unit wall thickness

(c) Per unit area per unit temperature difference

(d) None of these

7. The velocity of sound in a gaseous medium is governed by the relation CO2-U

(a) $v = \sqrt{\frac{B}{\rho}}$ (b) $v = \sqrt{\frac{B}{2\rho}}$ (c) $v = \sqrt{\frac{2B}{\tilde{n}}}$ (d) None of these

8. Sound waves with frequencies above 20 kHz are called CO2-U

(a) Ultrasonic (b) Supersonic (c) audible (d) None of these

9. The melting point of particles in nano form _____. CO1-U

(a) Increases (b) Decreases (c) Remains same (d) Increases then decreases

10. The conductivity of a nanowire much less than that of the corresponding bulk material due to scattering from _____ CO1-U

(a) Grains (b) Boundaries (c) Both grains and boundaries (d) None of these

PART – B (5 x 2= 10 Marks)

11. Draw the planes for Miller Indices (100), (110), and (111) CO1-U

12. Differentiate between Laser beam and ordinary light beam. CO2-U

13. Define internal energy in a thermodynamic system. CO1-U

14. What are the different methods for the production of ultrasonic waves? CO2-U

15. What is meant by glass transition temperature? CO1- U

PART – C (5 x 16= 80 Marks)

16. (a) Obtain the number of atoms per unit cell, coordination number, atomic radius and packing factor FCC lattice. CO1-U (16)

Or

(b) (i) What are miller indices? And describe Miller planes with the indices (hkl) with one example. CO1- U (16)

ii) Show that for a cubic lattice, the distance between two successive plane (hkl) is given by $d = \frac{a}{\sqrt{(h^2+k^2+l^2)}}$

17.	(a)	Derive Einstein's A and B coefficients using the Einstein's theory of stimulated emission.	CO3-App	(16)
		Or		
	(b)	Determine the thickness of the wire using the air-wedge method.	CO3-App	(16)
18.	(a)	Write briefly about Seebeck effect, Peltier effect, and Thomson effect.	CO1- U	(16)
		Or		
	(b)	Describe principle and working of a refrigerator.	CO1- U	(16)
19.	(a)	Using Sabine's formula, how the sound absorption coefficient of a material is determined.	CO5-App	(16)
		Or		
	(b)	Determine the velocity of ultrasonic waves in liquids using an acoustic grating.	CO5-App	(16)
20.	(a)	Explain briefly about shape memory alloys and also their applications.	CO1-U	(16)
		Or		
	(b)	Describe carbon nanotubes (CNT) and explain their properties and applications of the CNT.	CO1-U	(16)