A   **Reg. No. :**

Answer ALL questions

PART A - (10 x 1 = 10 Marks)

1. The coordination number for FCC lattice is   CO1- R

    (a) 12   (b) 6   (c) 8   (d) 24

2. The number of atoms per unit cell for a simple cubic crystal structure is   CO1- R

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

3. Atomic packing factor for BCC crystal lattice is   CO1- R

    (a) 32%   (b) 52%   (c) 74%   (d) 68%

4. If N_1 and N_2 are the number of atoms in ground state and excited state   CO2- R
    respectively, then in population inversion

    (a) $N_1 < N_2$ (b) $N_1 > N_2$ (c) $N_1 = N_2$ (d) $N_1 > 2N_2$

5. A hologram contains the information about   CO2- R

    (a) Amplitude of the object   (b) Phase of the object

    (c) Both amplitude and phase of the object   (d) None of these

6. If λ_m is the wavelength corresponding to maximum energy and T is the   CO3- R
    absolute temperature, then according to Wien's displacement law,

    (a) $\lambda_m T = $ constant   (b) $\lambda_m /T = $ constant   (c) $\lambda_m T^{1/2} = $ constant   (d) $\lambda_m / T^{1/2} = $ constant

7. According to Planck's hypothesis, the exchange of energy between the radiation and matter is not continuous but it is limited to the integral multiple of   CO3- R

(a) $1/h\nu$ (b) h/ν (c) ν/h (d) $h\nu$

8. If a particle having mass m is moving with velocity v, the deBroglie wavelength associated with the matter wave is   CO3- R

(a) $\lambda = h/mv$ (b) $\lambda = h/mv^2$ (c) $\lambda = h^2/mv$ (d) $\lambda = mv/h$

9. The modulus of elasticity is   CO4- R

(a) Stress $\times$ Strain   (b) Stress / Strain   (c) Strain / Stress   (d) Stress$\times$ Young's modulus

10. The ratio of lateral strain to linear strain is   CO4- R

(a) Elastic limit   (b) Young's modulus   (c) Rigidity modulus   (d) Poisson's ratio

PART – B (5 x 2= 10 Marks)

11. Calculate the Miller Indices of a plane which cuts the intercepts of 2, 3, 4 units along x, y and z axes respectively.   CO1- App

12. Define unit cell.   CO1- R

13. What is holography?   CO2- R

14. Mention any two physical significance of the wave function ψ.   CO3- R

15. State Hooke's law.   CO4- R

PART – C (5 x 16= 80 Marks)

16. (a) What are miller indices? Sketch two successive (110) planes. Show that for a cubic lattice the distance between two successive plane (h k l) is given by   CO5- App   (16)

$$d = \frac{a}{\sqrt{h^2 + k^2 + l^2}}$$
Or

(b) Explain with necessary diagram point defects and line defects that occur in crystals.   CO1- U   (16)

17. (a) Explain the modes of vibrations of CO_2 molecule. Describe the construction and working of CO_2 laser with necessary diagrams.   CO2- U   (16)
Or
(b) Describe the construction and working of CO_2 laser.   CO2- U   (16)

U1P03

18. (a) (i) Show that the atomic packing factor for FCC is 74%.   CO1- U   (8)

        (ii) Derive Schrodinger's time independent wave equation.   CO3- U   (8)

                                    Or

    (b) (i) Explain surface defects in crystals.   CO1- U   (8)

        (ii) Derive Schrodinger's time dependent wave equation.   CO3- U   (8)

19. (a) Explain three moduli of elasticity with suitable diagram.   CO3- U   (16)

                                      Or

    (b) Solve Schrodinger's wave equation for a particle lying in a one   CO3- U   (16)
dimensional box of length 'a'.

20. (a) A patient's leg was put into traction, stretching the femur from a   CO6- Ana   (16)
length of 0.46 m to 0.461 m. The femur has a diameter of 3.05 cm.
With the knowledge that bone has a Young's modulus of ~ 1.6×10^{10} in tension, what force was used to stretch the femur?

                                      Or

    (b) A circular and square cantilever is made of same material and has   CO6- Ana   (16)
equal area of cross-section and length. Analyzethe ratio of their
depression for a given load.

U1P03