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

Question Paper Code: R2P03

B.E./B.Tech. DEGREE EXAMINATION, NOV 2025

Second Semester

Civil Engineering

R21UPH203 - MATERIAL PHYSICS

(Regulations R2021)

(Common to Mech, Agri and Chemical Engineering branches)

Duration: Three hours | Maximum: 100 Marks

PART - A (10 x 1 = 10 Marks)

1. Calculate the interplanar distance for (321) plane in SC lattice with $a = 4.12 \times 10^{-10}$ m — CO3-App

   (a) 2.20×10^{-10} m (b) 1.01×10^{-10} m (c) 2.30×10^{-10} m (d) 3.20×10^{-10} m

2. A particular metal has a simple cubic unit cell. How many atoms of the metal are in each unit cell? — CO3-App

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

3. Rainbow is formed due to — CO2- U

   (a) scattering ,refraction (b) dispersion

   (c) reflection only (d) None of these

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. When water is kept in a very hot pan, the entire water heats up. Which mode of heat transfer is responsible for this? — CO1- U

   (a) Conduction (b) Convection

   (c) Radiation (d) Convection along with radiation

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

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

8. Echo of sound is more prominent if surface is_____ CO2- U

(a) Elastic (b) rigid (c) non-rigid (d) None of these

9. The conductivity of a nanowire much less than that of the corresponding bulk material due to scattering from _____ CO2- U

(a) grains (b) boundaries

(c) both grains and boundaries (d) None of these

10. Which one of the following is an example of zero-dimensional nanostructure? CO1- U

(a) Nanoparticles (b) Nanorods

(c) Nanotubes (d) All of the above

PART – B (5 x 2= 10 Marks)

11. A unit cell has the dimensions a=b=c = 4.74 Å and α=β=γ=60°.What is its crystal structure. CO1- U

12. State Snell's law of refraction. CO2- U

13. Mention the Kelvin-Planck statement of the second law. CO1- U

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

15. Define Quantum confinement. CO1- U

PART – C (5 x 16= 80 Marks)

16. (a) Determine the number of atoms per unit cell, coordination number, atomic radius and packing factor FCC lattice. CO3-App (16)

Or

(b) Obtain the HCP structure and show that the packing factor of the HCP is 0.74. CO3-App (16)

17. (a) Explain the formation of interference fringes in an air-wedge shaped film. How is the thickness of the wire determined by this method? CO2- U (16)

Or

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

18. (a) Derive the efficiency of a Carnot engine in terms of source and sink temperatures. CO4-App (16)

Or

(b) Discuss how the e.m.f. of a thermocouple is measured experimentally using Seeback effect. Estimate the e.m.f of a thermocouple when working between 0°C and 100°C. Its neutral temperature is 300° C and the values of *a* and *b* are 14.4×10^{-6} and -2.8×10^{-8}. CO4-App (16)

19. (a) Using Sabine's formula, how the sound absorption coefficient of a material is determined. CO5-App (16)

Or

(b) State the acoustic requirements of a good auditorium. Explain how these requirements can be achieved. CO5-App (16)

20. (a) Explain two important techniques that are used to produce metallic glass. CO1- U (16)

Or

(b) Describe carbon nanotubes (CNT) and explain their properties and applications of the CNT. CO1- U (16)