(6 pages) **Reg. No. :** .....

Code No. : 30459 E **Sub. Code : CMPH 63**

B.Sc. (CBCS) DEGREE EXAMINATION, NOVEMBER 2024.

Sixth Semester

Physics — Core

SOLID STATE PHYSICS

(For those who joined in July 2021 and 2022 only)

Time : Three hours Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. Atomic radius of Simple Cubic (SC) cell is

   (a) $\frac{a}{2}$ (b) $\frac{a\sqrt{3}}{4}$

   (c) $\frac{a}{2\sqrt{2}}$ (d) $\frac{a\sqrt{3}}{8}$

2. An example for Hexagonal close packed structure is

   (a) Quartz (b) Lead

   (c) Gold (d) Silver

3. Which is the weakest type of bonding in solids?

   (a) Ionic (b) Covalent

   (c) Metallic (d) Vanderwaal's

4. The cohesive energy of the ionic crystals is the order of _____ to _____

   (a) 5, 20 (b) 5, 10

   (c) 8, 9 (d) 10, 20

5. The contribution of polarization due to orientation of molecular dipoles is called

   (a) Ionic polarization

   (b) Space-charge polarization

   (c) Orientational polarization

   (d) Electronic polarization

6. Dielectrics are

   (a) Metals

   (b) Semiconductors

   (c) Insulating materials

   (d) None

7. Phenomenon of superconductivity was discovered by

   (a) K. ones (b) Meissner

   (c) Silsbee (d) Josephson

8. Which of the following is Type I superconductor?

(a) Vanadium (b) Gold

(c) Niobium (d) Lead

9. Which one of the following is an example for top-down approach?

(a) Ball milling technique

(b) Sol-gel process

(c) Both (a) and (b)

(d) None of the above

10. What are the uses carbon nanotubes?

(a) Uses in composities

(b) Used in battery technology

(c) Both (a) and (b)

(d) None of the above

PART B — (5 × 5 = 25 marks)

Answer ALL questions choosing either (a) or (b).
Each answer should not exceed 250 words.

11. (a) Describe the crystal structure of SC, BCC, FCC crystal.

Or

(b) Derive Bragg's law of X-ray diffraction crystal.

12. (a) Describe the formation and significance of hydrogen bonds in water molecule.

Or

(b) Discussion about the Sodium choloride crystal and its application.

13. (a) Explain in detail the classical theory of diamagnetism.

Or

(b) Explain the domain theory of ferromagnetism.

14. (a) Derive London equations.

Or

(b) State and explain isotope effect in superconductors.

15. (a) Explain in detail about Sol-gel method.

Or

(b) Brief notes on fullerene, graphene and carbon nano tubes.

PART C — (5 × 8 = 40 marks)

Answer ALL questions choosing either (a) or (b).

Each answer should not exceed 600 words.

16. (a) Explain the following structures with their diagram.

(i) NaCl structure

(ii) Zinc blende structure

(iii) Diamond structure.

Or

(b) What are Miller indices? Write the procedure for finding miller Indices of a given plane.

17. (a) Explain the process of Vanderwaal's bonding in crystals. What are the factors on which Vanderwaal's forces depends?

Or

(b) What is meant by the cohesive energy of a solid? Discuss the nature of the interactions that contributes to the cohesive energy of ionic solid.

18. (a) Derive the expression for Clausius – Mossotti relation.

Or

(b) Explain :

(i) Electronic polarization

(ii) Ionic polarization

(iii) Orientation polarization.

19. (a) Derive the expression AC and DC Josephson effect.

Or

(b) Write a short notes on BCS theory and application of super conductors.

20. (a) Describe the principle and experimental set up of electro deposition method.

Or

(b) Explain about the synthesis and classification of nanomaterials. What are the techniques used in synthesis of nanomaterials.

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