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M.Sc. (Fourth Semester)
EXAMINATION, MAY-JUNE, 2022
PHYSICS
Paper Third
(Solid State Physics - II)

Time : Three Hours] *[Maximum Marks : 80*

Note : Answer as per the instruction in each section.

(Section-A)

(Objective/Multiple Choice Questions)

(1 mark each)

Note- Attempt all questions.

Choose the correct answer.

1. Plasma contains:
   (A) Positively charged particles only
   (B) Negatively charged particles only
   (C) Neutral particles only
   (D) Both positively and negatively charged particles with over all neutrality

2. Electromagnetic wave of frequency W can propagate in plasma if - (W_0-plasma frequency)
   (A) $W > W_0$
   (B) $W = W_0$
   (C) $W < W_0$
   (D) None of these
3. Conductivity of plasma_____ with temperature:
   (A) Increases
   (B) Decreases
   (C) Unchanged
   (D) None of these
4. Polaritons are quasi-particles related to interaction between:
   (A) Electromagnetic Waves and Electrons
   (B) Electromagnetic Waves and Dipoles
   (C) Plasma Oscillations and Dipoles
   (D) None of these
5. In dielectrics, the polarization is _____ function of electric field
   (A) Linear
   (B) Quadratic
   (C) Logarithmic
   (D) Exponential

6. Molecular polarizability is produced due to:

   (A) Preferred orientation of dipoles

   (B) Relative displacement of nucleus and electrons

   (C) Displacement of ions

   (D) None of these

7. Ferro-electricity arises due to:

   (A) Nearly perfect alignment of permanent electric dipole

   (B) Enhanced ionic polarization

   (C) Enhanced Electronic polarization

   (D) None of these

8. A second order phase transition is one in which the plot of _____ as a function on temperature shows discontinuity.

   (A) Entropy

   (B) Specific Heat

   (C) Volume

   (D) Pressure

9. The temperature below which certain materials are ferromagnetic and above which these are paramagnetic is called:

   (A) Weiss temperature

   (B) Curie temperature

   (C) Neel temperature

   (D) Van Vleck temperature

10. Dimensions of susceptibility is:

    (A) Wb/m^2

    (B) Wb/m

    (C) amp/m

    (D) Dimensionless

11. What is the group number of iron?

    (A) 8

    (B) 2

    (C) 10

    (D) 20

12. By application of magnetic field at a fixed temperature, the entropy of the system:

    (A) Decreases

    (B) Increased

    (C) Remains unchanged

    (D) None of these

13. According to Curie-Weiss law, the susceptibility of diamagnetic substance is:

    (A) Less than 1

    (B) Equal to 1

    (C) Greater than 1

    (D) Infinite

14. Ferromagnetism is due to:

    (A) Spin of Atoms

    (B) Spin of Nucleus

    (C) Spin of Protons

    (D) Spin of Electrons

15. According to Heisenberg, the large molecular magnetic field is due to:

    (A) Coulomb Intersection

    (B) Spin-orbit Intersection

    (C) Exchange Intersection

    (D) Dipole-dipole Intersection

16. The Bloch Walls separate:

    (A) Two different semiconductors

    (B) Two differently doped layers of a semiconductor

    (C) Crystallites of polycrystalline material

    (D) Domains of ferromagnetic material

17. The electron capture in negative ion vacancy is known as:

    (A) K-Center

    (B) F Center

    (C) V-Center

    (D) F' Center

18. The following types of imperfections in crystals are not point defects:

    (A) Colour centers

    (B) Schottky defects

    (C) Dislocation

    (D) Interestials

19. A screw dislocation moves:

    (A) Perpendicular to its length and parallel to slip direction

    (B) Parallel to length and perpendicular to slip direction

    (C) Perpendicular to both, length & slip direction

    (D) Parallel to both length and slip direction

20. Increase in dislocation density causes:

    (A) Increase in hardness

    (B) Decrease in hardness

    (C) No change in hardness

    (D) Random change in hardness

(Section- B)

(Very Short Answer Type Questions)

(2 marks each)

Note : Attempt all questions.

1. Why alkali metals are transparent to ultraviolet light?

2. What is depolarization field?

3. What is meant by Ferro-elasticity?
4. Give Hund rule.
5. What are iron garnets?
6. What is meant by ferromagnetic domains?
7. Explain optical reflection.
8. Define dislocation density.

(Section - C)

(Short Answer Type Questions)

(3 marks each)

Note : Attempt all questions.

1. Explain longitudinal plasma oscillations.
2. Describe electrostatic screening.
3. Obtain relation between dielectric constant and polarizability.
4. Explain spectroscopic splitting factor.
5. Discuss temperature dependence of parmagnetism.
6. Discuss susceptibility of anti ferromagnetic materials below Neel temperature.
7. Explain quantization of spin waves.
8. Describe hardness of materials.

Section D

(Long Answer Type Questions)

(5 marks each)

Note:- Attempt any four questions.

1. Obtain dispersion relation of E.M. Waves.
2. Describe macroscopic electric field. Discuss various local fields contributing to the net field.
3. Explain cooling by demagnetization. What is the lowest temperature obtained by this method?
4. Discuss ferromagnetic order. Explain how the saturation magnetization depends on temperature.
5. Describe shear strength of single crystals and obtain its expressions.
6. Explain Ferro-electricity and anti Ferro-electricity.
7. What do you mean by part defects in crystals? Describe various types of point defects.