

Roll No. ....

**D-973****M. Sc. (Fourth Semester) (Main/ATKT)****EXAMINATION, May-June, 2020**

PHYSICS

Paper Third

**(Solid State Physics—II)***Time : Three Hours ] [ Maximum Marks : 80***Note :** Attempt all Sections as directed.**Section—A**

1 each

**(Objective/Multiple Choice Questions)****Note :** Attempt all questions.

Choose the correct answer :

1. Plasma oscillations are :

- (a) Displacement of positive ions in lattice
- (b) Rotation of electrons around positive ions
- (c) Uniform displacement of electrons
- (d) None of these

2. Polarization  $P$  in a solid dielectric is related to the electric field  $E$  and electric flux density  $D$  by relation :

- (a)  $D = E + \epsilon_0 P$
- (b)  $D = P + \epsilon_0 E$
- (c)  $E = \epsilon_0 D + P$
- (d)  $D = \epsilon_0 (E + P)$

3. Magnetic susceptibility is :

- (a) Magnetization per unit magnetic field
- (b) Dipole moment per unit volume
- (c) Charge per unit volume
- (d) None of these

4. In ferromagnetic materials, the large internal magnetic field is due to :

- (a) Coulomb interaction
- (b) Spin-orbit interaction
- (c) Exchange interaction
- (d) Dipole-dipole interaction

5. Colour centers are :

- (a) Point defects
- (b) Line defects
- (c) Planar defects
- (d) Volume defects

**P. T. O.**

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6. Conductivity of plasma ..... with temperature.
- (a) increases
  - (b) decreases
  - (c) remains same
  - (d) None of these
7. Dipolar polarizability is due to :
- (a) Displacement of positive and negative ions
  - (b) Relative displacement of nucleus and electrons
  - (c) Preferred orientation of molecular dipoles
  - (d) None of these
8. The number of iron group atom is :
- (a) 8
  - (b) 10
  - (c) 15
  - (d) 26
9. The particles associated with quantization of spin waves are :
- (a) Magnons
  - (b) Polarons
  - (c) Polaritons
  - (d) Plasmons
10. Motion of the dislocations in crystals causes :
- (a) Elastic deformation
  - (b) Plastic deformation
  - (c) Lattice vibrations
  - (d) None of these

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11. Plasmons are quasi-particles associated with :
- (a) Lattice vibrations in dielectrics
  - (b) Electron vibrations in metals
  - (c) Plasma oscillation
  - (d) None of these
12. In piezoelectric materials, electric field is produced by :
- (a) Mechanical deformation
  - (b) Exposure to light
  - (c) Magnetic field
  - (d) Heating
13. By application of magnetic field at a fixed temperature, the entropy of a magnetic system :
- (a) increases
  - (b) decreases
  - (c) remains same
  - (d) None of these
14. In ferrimagnetic materials, the magnetic moments of ions of lattice A and lattice B are :
- (a) equal
  - (b) unequal
  - (c) zero
  - (d) None of these

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15. An edge dislocation moves :
- (a) Perpendicular to slip direction
  - (b) Parallel to slip direction
  - (c) At some angle to slip direction
  - (d) None of these
16. In case of second order phase transition ..... changes abruptly at transition temperature.
- (a) density
  - (b) volume
  - (c) specific heat
  - (d) entropy
17. Susceptibility of diamagnetic material is :
- (a) positive and large
  - (b) negative and large
  - (c) positive and small
  - (d) Negative and small
18. At Neel temperature, the susceptibility of antiferromagnetic substance is :
- (a) Zero
  - (b) Minimum
  - (c) Maximum
  - (d) Infinite

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19. Which of the following is a line defect ?
- (a) Frenkel defect
  - (b) Dislocation
  - (c) Vacancy
  - (d) Color centre
20. Local thermal energy fluctuations results in production of :
- (a) Point defect
  - (b) Line defects
  - (c) Surface defects
  - (d) None of these

Section—B

1  $\frac{1}{2}$  each

(Very Short Answer Type Questions)

**Note :** Attempt all questions. Each question should be of 2-3 sentences.

1. What are Plasmons ?
2. What are Polaritons ?
3. Explain Ferroelectricity.
4. Describe optical ceramics.
5. Give Hund's rule.
6. What is nuclear demagnetization ?
7. What is meant by Magnons ?
8. Discuss iron garnet.

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9. What is Schottky defect ?
10. Define Burger vector.

**Section—C**

2  $\frac{1}{2}$  each

**(Short Answer Type Questions)**

**Note :** Attempt all questions. Each answer should be in 75 words.

1. Explain longitudinal plasma oscillations.
2. Describe metal-insulator transitions.
3. Discuss electronic polarizability.
4. Explain piezoelectricity.
5. Explain quenching of orbital angular momentum.
6. Describe susceptibility of conduction electrons.
7. Discuss saturation magnetization at absolute zero.
8. Describe quantization of spin waves.
9. Explain optical reflectance.
10. Discuss hardness of materials.

**Section—D**

4 each

**(Long Answer Type Questions)**

**Note :** Attempt all questions. Each answer should be  $\approx 150$  words.

1. Obtain dispersion relation for E-M waves.

*Or*

Explain electrostatic screening and screened Coulomb potential.

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2. What do you mean by structural phase transition ? Explain first and second order transitions.

*Or*

Explain polarization of materials and describe macroscopic electric field.

3. Describe quantum theory of paramagnetism.

*Or*

Discuss cooling by isotropic demagnetization.

4. Describe ferromagnetic order and describe how it is explained by exchange integral.

*Or*

Obtain explain susceptibility of antiferromagnetic substance below Neel temperature.

5. What are Excitons ? Describe the various types of excitons.

*Or*

Describe dislocation multiplication. How this causes slip in the crystals ?

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