

(Pages : 3)

T – 6592

Reg. No. :

Name :

Fourth Semester M.Sc. Degree Examination, July 2024

Physics

PH : 241 – CONDENSED MATTER PHYSICS

(2018-2019 Admission)

Time : 3 Hours

Max. Marks : 75

SECTION – A

Answer **any five** questions. Each question carries **3** marks.

1. (a) Give a short note on space lattice.
- (b) What is meant by Thermal conductivity?
- (c) Write a note on Hall effect?
- (d) What are free carriers?
- (e) Define the term piezoelectricity.
- (f) Explain superconductivity.
- (g) Give the significance of sputtering technique in nanoscience.
- (h) Comment on Fermi-Dirac statistics.

(5 × 3 = 15 Marks)

P.T.O.



SECTION – B

Answer **all** questions. Each question carries **15** marks.

2. (A) Explain in detail the fundamental types of lattices in 2D and 3D.

OR

(B) Explain the importance of

- (a) Kronig Penny model of band theory
- (b) Brillouin zones

3. (A) Discuss on the free carrier concentration in semiconductors.

OR

(B) Give a detailed discussion on the following :

- (a) Langevin's theory
 - (b) ferromagnetism and anti-ferromagnetism
4. (A) Give a detailed account on the concept of
- (a) BCS theory of superconductivity
 - (b) AC and DC Josephson effect in superconductors

OR

(B) Comment on the characterisation techniques.

- (a) X Ray diffraction
- (b) Scanning electron microscopy

(3 × 15 = 45 Marks)



SECTION – C

Answer **any three** of the following questions. Each question carries **5** marks.

5. (a) A plane makes intercepts of $3 \text{ \AA}$, $5 \text{ \AA}$, and $4 \text{ \AA}$ along crystallographic axis of orthorhombic crystal whose lattice parameters are in ratio $3 : 2 : 1$. Find miller indices.
- (b) Show that kinetic energy of a 3D gas of N free electrons at 0 K is
$$U_o = \frac{3}{5} N E_F.$$
- (c) Show that potential energy of a dipole in a field is given by $v = -p \cdot \epsilon \cdot \cos \theta$.
- (d) Give a brief account on Ginzburg-landau theory.
- (e) Two positive unit charges are separated by distance ' $2a$ ' which are collinear. with origin at centre of two charges. Find the dipole moment of the configuration.
- (f) Characterization techniques in nanoscience and technology plays a chief role. Justify.

(3 × 5 = 15 Marks)



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5. (a) A plane makes intercepts of $3 \text{ \AA}$, $5 \text{ \AA}$, and $4 \text{ \AA}$ along crystallographic axis of orthorhombic crystal whose lattice parameters are in ratio $3 : 2 : 1$. Find miller indices.
- (b) Show that kinetic energy of a 3D gas of N free electrons at 0 K is
$$U_0 = \frac{3}{5} NE_F.$$
- (c) Show that potential energy of a dipole in a field is given by $v = -p \cdot \epsilon \cdot \cos \theta$.
- (d) Give a brief account on Ginzburg-landau theory.
- (e) Two positive unit charges are separated by distance ' $2a$ ' which are collinear. with origin at centre of two charges. Find the dipole moment of the configuration.
- (f) Characterization techniques in nanoscience and technology plays a chief role. Justify.

(3 × 5 = 15 Marks)

