

(i) Printed Pages: 3

Roll No. ....

(ii) Questions : 7

Sub. Code : 

0	5	4	4
---	---	---	---

Exam. Code : 

0	0	0	6
---	---	---	---

B.A./B.Sc. (General) 6<sup>th</sup> Semester

(2042)

## PHYSICS

Paper—A : Condensed Matter Physics—II

Time Allowed : Three Hours]

[Maximum Marks : 44

**Note :—** Attempt *five* questions in all, including Question No. 7 (Unit-III) which is compulsory and selecting *two* questions each from Units I & II. Use of non-programmable scientific calculator is allowed.

### UNIT—I

1. (a) Discuss a diatomic linear lattice. Obtain the dispersion relation and differentiate between the optical and acoustic branches. 7
- (b) Find the Debye temperature for gold. The density of gold is  $19000 \text{ kg/m}^3$  and velocity of sound is  $2100 \text{ m/s}$ . Take the atomic mass of gold as 197. 2
2. (a) What is the atomic magnetic moment ? Derive an expression for the total magnetic moment of the electrons in an atom. 7
- (b) Calculate the Lande's  $g$  - factor for an ion in the  $^2S_{1/2}$  state. Also, find the total magnetic moment. Given,  $\mu_B = 9.27 \times 10^{-24} \text{ JT}^{-1}$ . 2



3. (a) Explain Weiss Theory of Ferromagnetism and derive the expression  $\chi = \frac{C}{T - T_c}$ . 7

(b) Distinguish between Ferromagnetic, Paramagnetic and Diamagnetic substances. 2

### UNIT—II

4. (a) What is atomic polarizability ? Derive relation between electric dipole moment and atomic polarizability. 7

(b) What are Ferrites ? Briefly discuss their types and application. 2

5. (a) Define dielectric constant  $K$  and electric susceptibility  $\chi_e$ . Prove that  $K = 1 + \chi_e$ . 7

(b) Write a short note on dielectric breakdown. 2

6. (a) What is Josephson effect ? Give necessary theory used to explain D.C. Josephson effect and A.C. Josephson effect. 7

(b) Write a short note on fabrication of the nanomaterials and their two important characteristics. 2

### UNIT—III

7. Attempt any *eight* of the following :

(a) What is Bohr Magneton ?

(b) Distinguish between polar and non-polar molecules.

(c) Define piezoelectric effect.



- (d) Why soft iron is used to make the core of transformers ?
- (e) What is Silsbee effect ?
- (f) What is Neel temperature ?
- (g) What are Type-I and Type-II superconductors ?
- (h) What do you mean by Fullerenes ?
- (i) Why do the properties of the material change on nano scale ?
- (j) What is Atomic Force Microscopy ?

8×1