(i)   **Printed Pages : 3**   Roll No. ....

(ii) **Questions   : 9**   Sub. Code : | 3 | 7 | 2 | 3 |

Exam. Code : | 0 | 4 | 7 | 5 |

M.Sc. Physics 4th Semester
1059

CONDENSED MATTER PHYSICS—II.
Paper–PHY-7052

Time Allowed : Three Hours]   **[Maximum Marks : 60**

Note :— Attempt *five* questions in all selecting *one* question each from unit I—IV. Unit V is compulsory.

UNIT—I

1.   (a)   Discuss the optical absorption in case of conducting and insulating media in detail.

(b)   Differentiate the direct and indirect band gap semiconductors on the basis of optical absorption.   8,4

2.   (a)   What is the piezoelectric effect and its cause ? How stress and strain are propagated in them due to electric field ? Discuss some applications of piezoelectricity.

(b)   Discuss the Weiss theory of ferroelectricity. Give some applications of ferroelectric materials.   8,4

UNIT—II

3.   (a)   Draw the temperature dependence of the susceptibility of all types of magnetic materials and comment also. Explain the Heisenberg's exchange interaction in ferromagnetism.

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(b) Why diamagnetism is property of all materials and prove

$$\chi_d = -\frac{N\mu_0 z e^2 <r^2>}{6m}.$$

7,5

4. (a) Derive an expression for dispersion relation for spin waves in ferromagnets in one dimension. Show that fractional change of magnetisation is proportional to $T^{3/2}$.

(b) Discuss Neel theory of antiferromagnetism in detail.   8,4

UNIT—III

5. (a) Enumerate the properties of type I and type II superconductors. Derive the London's equations and discuss how do they help in explaining the superconductivity.

(b) Briefly outline BCS theory of superconductivity and describe one experimental evidence for existence of energy gap.   6,6

6. (a) Discuss the a.c. Josephson effect. Show that the current oscillates with frequency $w = \frac{2ev}{h}$.

(b) What is Meissener effect and flux quantization ?   8,4

UNIT—IV

7. (a) Explain the concept of presence dislocation and their types. Show that critical resolved shear stress (CRSS) for plastic deformation to start is $\tau_c = \sigma_c \cos \phi \cos \lambda$.

(b) What force does it take in the [110] direction to have resolved force of 130 N in the [100] direction of cubic crystal ?

8,4

8. (a) Sketch the climbing up and climbing down of an edge dislocation and discuss the effect on vacancy concentration in each process.

    (b) Prove that elastic strain energy per unit length of dislocation in the grain boundary is $\dfrac{Gb^2}{4\pi(1-v)}(-\log\theta + \log\alpha)$.   6,6

UNIT—V

9. Do any **SIX** :—

    (a) Define critical magnetic field.

    (b) What is penetration depth ?

    (c) Explain the Block wall & domain wall energy ?

    (d) What is Bohr magneton ?

    (e) How do colour centre affect the density of the crystal ?

    (f) Write down Clausius – Mossotti equation and explain the symbols.

    (g) Explain the difference between fluorescence and phosphorescence. $6\times2=12$