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

(ii) **Questions : 9** **Sub. Code :** | 3 | 7 | 2 | 6 |

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

**M.Sc. Physics 4th Semester**

**(2042)**

**CONDENSED MATTER PHYSICS—II**

**Paper—PHY-8046**

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

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

## UNIT—I

1. (a) Discuss ferroelectricity including spontaneous polarization and polarization catastrophe. Explain the reversal of polarization in Piezoelectric materials. Must all pyroelectric materials be ferroelectric also ? 10

   (b) Prove that the response time $t_o$ is directly proportional to the photoconductivity at a given illumiuation level and that the gain is equal to the ratio of the carrier life time to the transit time of a carrier between electrodes. 6

2. (a) What is fundamental absorption ? Absorption process involving impurities. Differentiate interband and intraband transitions. 10

   (b) Can optical absorption lead to Piezoelectric effect ? Give reasons and illustrations. 6

## UNIT—II

3. (a) What are spin waves and their quantization ? Are there any antiferromagnetic magnons that exist ? 10

   (b) Discuss origin and nature of Weiss Molecular field. What are super exchange interactions ? 6

4. (a) Discuss molecular field theory of antiferromagnetics in detail. Differentiate it from molecular field theory of ferromagnetics. 10

   (b) What are ferrities and discuss their structures ? 6

## UNIT—III

5. (a) How the phenomenon of super conductivity was explained on the basis of BCS theory ? 10

   (b) Explain the importance of London's equations in estimation of penetration depth and coherence length. 6

6. (a) Discuss the AC and DC Josephson effect. What was the physical basis of it ? 10

   (b) Discuss the thermodynamic transitions between super conductor to normal in terms of entropy and specific heat. 6

## UNIT—IV

7. (a) Describe how the movement of atoms in a crystal might be accomplished by the motion of vacancies. Could the same result be achieved by the motion of self-interstitials ? 8

   (b) Sketch how two edge dislocations of opposite sign on the same slip plane can annihilate each other. Can two screw dislocations of opposite sign also annihilate each other ? 8

8. (a) Distinguish among the direction of the dislocation line, the Burgers vector and the direction of motion for both edge and screw dislocations, differentiating between positive and negative types. 10

(b) A copper crystal has a dislocation density of $1.0\times10^{13}$ $m^{-2}$. The shear modulus of copper is 44 $MNm^{-2}$. Calculate the elastic energy of line imperfection stored in the crystal. 6

## UNIT—V

9. (a) What is the difference between Bohr's magneton and nuclear magneton ?

(b) What is the difference between normal and superconducting electrons ?

(c) How density of the crystal is affected due to Schottky defects ?

(d) How the critical field of a superconductor varies with temperature ?

(e) How density of the crystal is affected due to Schottky defects ?

(f) Distinguish between intrinsic and extrinsic vacancies.

(g) What is the difference between normal and superconducting electrons ?

(h) What are the potential applications of superconductors ? $8\times2=16$