

- (i) Both masses become equal.
- (ii) Lighter mass reduces to zero.
- (iii) Heavier mass increases to infinity.
- (c) Define susceptibility. Also discuss briefly about Weiss theory of Ferromagnetism? (5)
5. (a) What do you understand by polarization in a dielectric material? Describe different types of polarization mechanism. (10)
- (b) What is Meissner's effect? Explain in detail with diagram. How it can be used to distinguish between Type I and Type II superconductors. (8)
6. (a) Discuss the formation of allowed and forbidden energy band gap on the basis of Kronig-Penny model for 1D periodic potential. (12)
- (b) Define the effective mass of an electron. Give its significance. The energy near the valence band gap of a crystal is given by $E = -AK^2$ where $A = 10^{-39} \text{ Jm}^2$. Calculate the effective mass of the electron? (6)

(1000)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 3070

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Unique Paper Code : 2224002002

Name of the Paper : Solid State Physics
(GE paper)Name of the Course : B.Sc. Hons.-(Physics)_NEP:
UGCF-2022

Semester : III/V

Duration : 3 Hours Maximum Marks : 90

Instructions for Candidates

1. Write your Roll. No. on the top immediately on receipt of this question paper.
2. Answer five questions in all.
3. Question No.1 is compulsory.
4. All questions carry equal marks.

P.T.O.

1. Attempt any six parts. (3x6=18)
 - (a) Write two main differences between Van der Waals and Hydrogen bonding? Give one example of each.
 - (b) Calculate Atomic Packing Factor of a *fcc* structure.
 - (c) Describe the concept of ferromagnetic domains in a ferromagnetic material.
 - (d) Define phonons? How they are different from photons?
 - (e) Discuss the effect of magnetic field on a superconductivity behavior of a superconductor.
 - (f) Write three differences between Ferroelectricity and Piezoelectricity.
 - (g) What is the difference between **photoconductivity** and **photo-luminescence**?
2. (a) Discuss the wave mechanical concept of an atom. What are the failures of Bohr's atomic model? (9)

- (b) What do you understand by symmetry in crystals? Explain translation, rotation and reflection symmetry elements with reference to cubic structure? (9)
3. (a) What do you understand by Miller indices of a crystal plane? Show that in a cubic crystal with lattice parameter 'a' the interplanar spacing 'd' between consecutive parallel planes of the Miller indices (h k l) is given by

$$d = \frac{a}{\sqrt{h^2 + k^2 + l^2}} \quad (9)$$
- (b) Establish Laue Equations starting from scattering amplitude and then find relation of Laue Equation to Bragg's Law in reciprocal lattice (9)
4. (a) Derive the dispersion relation for the vibrational mode of mono-atomic linear lattice having masses m. (10)
- (b) Explain the behaviour observed in acoustical and optical branches of diatomic linear atomic chain when (3)