Reg. No. : ..... (Pages : 2) **1025**

Name : .....

Fourth Semester M.Sc. Degree Examination, June 2007

Branch – II – PHYSICS

PH-241 : Condensed Matter Physics

Time: 3 Hours Max. Marks: 75

PART – A

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

I. a) What is a Brillouin zone ?

b) Explain phonon momentum.

c) What is Friedman-Franz law ?

d) State and explain Bloch theorem.

e) Explain effective mass tenson.

f) Explain ferromagnetic domains.

g) What are magnons and helicons ?

h) What are SQUIDS ?

(3×5=15 Marks)

PART – B

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

II. A) How dymmetry elements are identified ? Give their characteristics. Explain formation of point groups with examples. Distinguish between point groups and space groups.

OR

B) What are the bonds found in a crystal ? Explain with examples. Give the Einstein theory for specific heats. **15**

III. A) Derive an expression for the heat capacity of electron gas. Why the heat capacity of metals vary from these values ?

OR

B) Discuss Kronig-Penny model. How it can lead to the solutions of periodic potential problem ? **15**

P.T.O.

IV. A) Derive the Langevin equations for diamagnetism and paramagnetism. Hence obtain Curic law.

OR

B) Derive the London equation and penetration depth for super conductors. Explain the terms energy gap and isotopic effect. **15**

PART – C

Answer **any three** questions. **Each** question carries **5** marks.)

V. a) Show that the packing fraction of an hep crystal is 0.74.

b) Find the total energy of a longitudinal wave u (x) = u cos (wt – ska) that propagates in a monotonic lattice of mass M, spacing a and nearest neighbour interaction C.

c) The powder diffraction pattern of a bcc crystal is recorded using Cu K_α x-rays of wavelength 1.54 Å. If the (002) planes different at 60°, find the lattice parameter.

d) If the atomic mass of the constituent atom of a bcc crystal is 50.94 amu, find the density of the crystal in units of kg/m^3.

e) The energy $E(\vec{k})$ of electron of wave vector $\vec{k}$ in a crystal is given by $E(\vec{k}) = Ak^2 + Bk^4$, where A and B are constants. Find the effective mass of the electron at $|\vec{k}| = K_o$.

f) The plasma frequency of a free electron gas is 5.7×10^{15} at a number density of 10^{28} electrons/m^3. If the number density changes to 10^{26} electrons/m^3, find the new plasma frequency (in Hz). **(5×3=15 marks)**

$\frac{dJs}{dt} = \frac{ne^2}{m} E$