T.Y.B.SC. SEM – V (2014 Course) : WINTER - 2018

SUBJECT: PHYSICS SOLID STATE PHYSICS

Day : Friday
Date : 12/10/2018

W-2018-0835

Time: 12.00 NOON TO 02.00 PM
Max. Marks: 40.

N.B.:

1) All questions are **COMPULSORY**.
2) Figures to the **RIGHT** indicate full marks.
3) Draw neat and labelled diagrams **WHEREVER** necessary.

Q.1 Attempt any **TWO** of the following: **(10)**

a) Obtain an expression for the interplaner spacing for the simple cubic structure.

b) Derive an expression for heat capacity of a solid material based on classical theory.

c) Distinguish between metal semiconductor and insullator on the basis of band theory.

Q.2 Attempt any **TWO** of the following: **(10)**

a) Using Ewald,s construction, show that diffraction condition for the reciprocal lattice is exactly equivalent to $2d\sin\theta = n\lambda$ in direct lattice.

b) What is Hall Effect? Show that Hall Coefficient is equal to $1/n_e$.

c) Find the expression for the specific heat of a solid based on the Einstein model and show that it converges to3R at high temperatures.

Q.3 Attempt any **TWO** of the following: **(10)**

a) What is symmetry operation? Explain any two symmetry operations with illustration.

b) Discuss the method of investigating the structure of single crystal using X-ray.

c) Obtain an expression for energy levels and density of states in one dimension.

Q.4 Attempt any **FIVE** of the following: **(10)**

a) For the elastic continuum the number of modes of vibrations is given by $Z(\nu)\, d\nu = 4\pi V \nu^2 (2/C_t^3 + 1/C_l^3)\, d\nu$, Explain the notation used.

b) Define i) a primitive cell and ii) unit cell.

c) How does the Debye model differ from the Einstein's model of lattice heat capacity?

d) The planes (111) and (222) are different but directions are (111) and (222) are same. Draw neat sketches.

e) Explain the terms Fermi energy & Fermi level.

f) A plane has intercepts on the three axis a, b, c as 3a, 2b, 5c respectively. What are its miller indices?

g) Calculate the distance between two lattice planes which give first order diffraction at an angle of 26.42 degree with molybdenum X-ray of wavelength 0.75 A°.

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