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BF—105—2016

FACULTY OF SCIENCE

B.Sc. (Third Year) (Fifth Semester) EXAMINATION

NOVEMBER/DECEMBER, 2016

(Old Course)

PHYSICS

Paper-XIII-A

(Solid State Physics)

(Friday, 9-12-2016)

Time : 10.00 a.m. to 12.00 noon

Time—2 Hours

Maximum Marks—40

N.B. :— (i) All questions are compulsory.

(ii) All questions carry equal marks.

1. Attempt any *four* : 8

- (a) Define Lattice and Basis.
- (b) What is meant by point and space group ?
- (c) Enlist any *four* assumptions of classical theory of specific heat.
- (d) Write *four* outstanding properties of metals.
- (e) Define N and P type semiconductors.
- (f) What are donor and acceptor levels ?
- (g) State Wiedemann-Franz Law.

2. Attempt any *two* : 8

- (a) Draw the diagrams for the conventional unit cells of triclinic, monoclinic, cubic and trigonal Bravais lattice.
- (b) Derive an expression for specific heat of solid using Einstein's model.
- (c) Describe PN junction theory in brief.

3. Attempt any *two* : 8

- (a) Assuming the expression for energy as

$$E = 9 N K_B T \left(\frac{T}{\theta_D} \right)^3 \int_0^{\frac{\theta_D}{T}} \frac{x^3}{e^x - 1} \cdot dx$$

derive expression for the specific heat at high and low temperature.

P.T.O.

- (b) Show that packing fraction of BCC lattice is 0.68.
- (c) Describe in brief quantum theory of free electron in a box.
4. Attempt any *one* : 8
- (a) Derive expressions for electrical and thermal conductivities and hence derive Wiedemann-Franz law.
- (b) Obtain an expression for the density of conduction holes in *p*-type semiconductor.
5. Write short notes on any *two* : 8
- (a) Bravais lattices in two dimension
- (b) Limitations of Debye's model of specific heat of solids
- (c) Drude-Lorentz theory
- (d) Difference between conductor, insulator and semiconductor.