

Roll No. ....

Total Pages : 3

**235502**

**December, 2019**

**B.Sc. (Physics) - V SEMESTER**

**Solid State Physics (BPH 502)**

Time : 3 Hours]

[Max. Marks : 75

*Instructions :*

1. *It is compulsory to answer all the questions (1.5 marks each) of Part-A in short.*
2. *Answer any four questions from Part-B in detail.*
3. *Different sub-parts of a question are to be attempted adjacent to each other.*

**PART - A**

1. (a) Describe the structure of diamond. (1.5)  
(b) Intercepts of a plane in crystal is given by  $a$ ,  $b/2$ ,  $3c$  in a simple cubic unit cell. Deduce the Miller indices of the system. (1.5)  
(c) Lattice parameters of a bravais lattice is given by  $a = 1.08$  nm,  $b = 0.947$  nm and  $c = 0.52$  nm and  $\alpha = 41^\circ$ ,  $\beta = 82^\circ$  and  $\gamma = 95^\circ$ , it belongs which to crystal system? (1.5)

225502/80/111/307

[P.T.O.  
13/12

- (d) What is the qualitative difference in the optical and acoustical modes of lattice vibration? (1.5)
- (e) Define density of states and its importance. (1.5)
- (f) What are valence and conduction bands? (1.5)
- (g) Define curie temperature for ferromagnetic materials. (1.5)
- (h) What is electronic polarization? (1.5)
- (i) Compare type I and type II superconductors. (1.5)
- (j) Give an example of ferroelectric material with single curie transition temperature. (1.5)

**PART - B**

- 2. (a) What is packing factor? Determine the Atomic Packing factor of FCC. (5)
- (b) Show that fivefold rotation symmetry is not possible in crystals. (5)
- (c) Show that reciprocal lattice of bcc is fcc and vice-versa. (5)
- 3. (a) Comment on the variation of  $m^*$  with  $k$  in the first Brillouin zone with the relevant pictorial representation. (5)

- (b) Explain the formation of bands in solids with the help of Kronig Penny model. (10)

- 4. Derive the Curie-Weiss law for ferromagnetic materials and show that above curie temperature ferromagnetic materials converts into paramagnetic material. (15)
- 5. (a) Derive the Clausius-Mossotti equation for dielectric materials and explain its significance also. (5)
- (b) Compare the hysteresis curve of ferroelectric and ferromagnetic materials. (10)
- 6. (a) What are London equations? Enumerate their salient contributions in justifying Meissner effect. (5)
- (b) Discuss the outstanding contribution of BCS theory. Also list its limitations. (5)
- (b) Calculate the structure factor of NaCl crystal. (5)
- 7. (a) Differentiate between the piezoelectric and pyroelectric materials. (5)
- (b) What is phonon? Derive an expression for diatomic crystal and also explain its dispersion graph. (10)