Roll No. .....

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238203

May, 2019

M. Sc. (Physics)-2nd Semester

Condensed Matter Physics (PHL-203)

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) Explain the terms primitive cell and unit cell. (1.5)

(b) Calculate the atomic radii in case of *bcc* and *fcc* lattices. (1.5)

(c) Show that packing factor for *fcc* lattice is $\sqrt{2}/6$. (1.5)

(d) What are polarons? (1.5)

(e) Explain photon momentum. (1.5)

(f) What do you mean by effective mass of an electron in energy band? (1.5)

(g) Write expression for density of electrons in conduction band. (1.5)

(h) What is meant by density of states in metals? (1.5)

(i) What is Fermi surface? (1.5)

(j) What is Quantum Hall effect? (1.5)

PART–B

2. (a) Discuss the various types of symmetry elements present in crystals. (10)

(b) Show analytically that a fivefold rotation axis does not exist in a crystal lattice. (5)

3. (a) Show that the atomic packing factors for *fcc* and *hcp* metals are the same. (5)

(b) What is reciprocal lattice? Calculate the reciprocal lattice vectors of simple cubic and *fcc* lattices. (10)

4. Discuss the vibration of diatomic lattice and describe it's optical and acoustical modes. Also explain quantization of lattice vibrations. (15)

5. (a) Write a short note on electron phonon interaction. (5)

(b) Describe the inelastic scattering of neutrons for the experimental determination of phonon spectra. (10)

6. (a) What do you mean by Brillouin zone? How is it constructed? (10)

(b) Distinguish between the metals, insulators and semiconductors on the basis of band theory of solids. (5)

7. Give the tight binding approximation of electrons in a crystal. Show how it leads to the formation of energy bands in solids. Also explain Hass-Van Alphen effect. (15)