



PBC-003-04950005 Seat No. _____

**B. Sc. / M. Sc. (Applied Physics) (Sem. V)
(CBCS) Examination**

November / December - 2018

**Applied Condensed Matter Physics : Paper - XIX
(New Course)**

Faculty Code : 003

Subject Code : 04950005

Time : $2\frac{1}{2}$ Hours]

[Total Marks : 70

Instructions : (1) All questions are compulsory.

(2) Numbers in the right indicate marks.

1 Attempt any **seven** short questions : **14**

- (1) Define Miller Indices & Crystal Planes.
- (2) Define primitive and non-primitive unit cell.
- (3) Draw (101) and (110) planes in cubic unit cell.
- (4) Define Bravais and non-Bravais lattice.
- (5) What are color centres?
- (6) What are Brillouin Zones? Draw first Brillouin Zone in Cubic lattice.
- (7) What are cooper pairs?
- (8) What is isotope effect in superconductor?
- (9) List various defects in solids.
- (10) State the Bloch Theorem for periodic potential.

- 2** (a) Write answers of any **two** : **10**
- (1) Explain in detail the formation of Schottky and Frenkel defects.
 - (2) Describe various X-Ray diffraction methods with a detailed note on Powder diffraction method.
 - (3) Define T_c and H_c in superconductor. Describe Type-I and Type-II superconductors with proper examples.
 - (4) Describe the method of determination of Miller Indices of crystal plane having x intercept on X-axis, y intercept on Y-axis and no intercept on Z-axis.
- (b) Write answer of any **one** : **4**
- (1) Define superconductivity and hence explain qualitatively, the BCS theory of superconductivity.
 - (2) Prove that zero resistance and perfect diamagnetism are necessary but independent properties of superconductor.
- 3** (a) Write answers of any **two** : **10**
- (1) Derive an expression for the concentration of Vacancy defects in crystalline solid.
 - (2) Classify various magnetic materials on the basis of their properties. Give suitable examples.
 - (3) State and prove the Bragg's law of X-Ray diffraction.
 - (4) Write a note on Ferrites and their applications.

- (b) Write answer of any **one** : 4
- (1) Draw a well labelled diagram of Diamond crystal structure and describe its features.
 - (2) If the average energy required to create a vacancy in metal is 1 eV. Calculate the ratio of vacancies created in metal at 1200 K and 400 K.
- 4 (a) Write answers of any **two** : 10
- (1) Describe various point group symmetry elements using proper diagrams.
 - (2) Explain seven crystal systems and fourteen Bravais lattices.
 - (3) Using Kronig-Penney model, explain the formation of allowed and forbidden energy bands in solids.
 - (4) Describe the Antiferromagnetism and Ferrimagnetism.
- (b) Write answer of any **one** : 4
- (1) Explain the concept of Effective Mass of Electron.
 - (2) Write a note: Paramagnetism in iron group ions.
- 5 (a) Write answers of any **two** : 10
- (1) What is Meissner Effect? Write a note on the properties of superconductors.
 - (2) Derive an expression for the concentration of interstitial defects in solids.

- (3) Describe various methods of energy band calculations? Describe Tight Binding method in detail.
- (4) Prove the Bloch theorem for periodic potential and give the properties of Bloch function.

(b) Write answer of any **one** : 4

- (1) Describe line defects and plane defects.
 - (2) Describe various applications of Superconductors.
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