LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

M.Sc. DEGREE EXAMINATION – **PHYSICS**

FOURTHSEMESTER – APRIL 2018

16PPH4MC03/PH4812 - SOLID STATE PHYSICS

Date: 23-04-2018 Dept. No. Max. : 100 Marks

Time: 01:00-04:00

Part-A

Answer **ALL** questions (10 x 2 = 20)

1. A crystal is not a lattice but a latticed array of atoms- substantiate this statement.
2. Mention the essential conditions for a cell to be primitive.
3. State the conditions for the effective mass to be positive or negative.
4. Draw the diagram for extended zone scheme.
5. Write the relation connecting the dielectric constant and dielectric susceptibility.
6. Give examples for crystals belonging to the displacive group of ferroelectrics.
7. Illustrate Hund's rule with Pr^{3+} ion.
8. State the main reasons attributed to the failure of independent electron approximation.
9. Mention the unique features of Cooper pair.
10. Highlight the isotope effect for superconductor.

Part-B

Answer any **FOUR** questions **(**4 x 7.5 = 30)

11. With suitable diagrams, discuss the various types of point group symmetry operations.
12. Based on the Kroning-Penney model, discuss the characteristic features of electron propagation in crystals.
13. Obtain the Clausius-Mossotti equation for cubic symmetry system.
14. What are magnons? Discuss the thermal excitation in magnons and obtain the Bloch $T^{3/2}$ law.
15. Explain Meissner effect and distinguish between type I and type II superconductors.
16. Draw the diagrams for 14 Bravais lattices and discuss the conditions.

Part-C

Answer any **FOUR** questions **(**4 x 12.5 = 50)

17. Discuss the condition for setting up the optical and acoustical branches based on the lattice vibrations in a linear diatomic lattice.

18. Outline the procedure for fabricating extrinsic semiconductors and hence derive the expression for carrier concentration.
19. With suitable diagrams, discuss the Hall effect in semiconductors and highlight the significance of Hall coefficient.
20. Based on the Weiss theory of ferromagnetism, obtain an expression for magnetization and illustrate its variations with temperature with necessary plots.
21. With necessary diagrams, explain the ac and dc Josephson effects.
22. Define atomic scattering factor and structure factor. Discuss extinction rules for BCC, FCC and ZnS structure.

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