BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: IMSC **SEMESTER : V**
BRANCH: PHYSICS **SESSION : MO/2023**

SUBJECT: PH302 SOLID STATE PHYSICS

TIME: 3 Hours **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

			CO	BL
Q.1(a)	Illustrate the properties of a reciprocal lattice. Show that FCC lattice is reciprocal to BCC lattice.	[5]	CO1	BL2
Q.1(b)	What is the geometrical structure factor? Determine the geometrical structure factor for a BCC crystal and account for the missing reflections for it.	[5]	CO1	BL5
Q.2(a)	Develop the dispersion relationship for a one-dimensional atomic crystal and explain the nature of acoustic and optical modes.	[5]	CO2	BL6
Q.2(b)	Derive an expression for the lattice specific heat capacity of a solid using the Einstein model. Outline the successes and failures of this model.	[5]	CO2	BL2
Q.3(a)	Develop an expression for paramagnetic susceptibility using Langevin's theory of paramagnetism.	[5]	CO3	BL6
Q.3(b)	Explain the Weiss theory of ferromagnetism and give an account of hysteresis and Curie point in Ferromagnetic materials based on this theory	[5]	CO3	BL5
Q.4(a)	What is the Hall coefficient? Show that for a p-type semiconductor the Hall coefficient is given by: $R_H = \frac{1}{pe}$	[5]	CO4	BL2
Q.4(b)	Using the extended zone scheme, explain the formation of allowed and forbidden energy bands	[5]	CO4	BL5
Q.5(a)	What are superconductors? Show that the behavior of a superconductor different from a perfect conductor.	[5]	CO5	BL2
Q.5(b)	Derive London's equations and explain the term coherence length.	[5]	CO5	BL5

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