

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

CLASS: IMSC
BRANCH: PHYSICS

SEMESTER : V
SESSION : MO/2024

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.
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			CO	BL
Q.1(a)	What are Miller indices? Determine the interplanar spacing between two parallel planes with Miller indices (h, k, l) in a cubic crystal of side a.	[5]	CO1	BL2
Q.1(b)	What are Brillouin zones? What kind of first Brillouin zone will you expect in a two-dimensional rectangular lattice with lattice parameters: $a_1 = a$, $a_2 = 2a$. Explain it with the help of a diagram.	[5]	CO1	BL5
Q.2(a)	Explain the phonon dispersion curve for a diatomic lattice with a basis consisting of two atoms of masses m and M ($m < M$) placed along x-axis with interatomic distance a. Differentiate between its optical and acoustic branches.	[5]	CO2	BL5
Q.2(b)	How does the Debye model differ from the Einstein model of lattice heat capacity? What is Debye T^3 law?	[5]	CO2	BL2
Q.3(a)	Derive an expression for paramagnetic susceptibility and define Curie law of Paramagnetism.	[5]	CO3	BL5
Q.3(b)	Derive the Clausius - Mossotti relation expressing the relationship between dielectric constant and atomic polarizability.	[5]	CO3	BL5
Q.4(a)	What is piezoelectricity? Why do piezoelectric crystals having centre of inversion show no piezoelectricity?	[5]	CO4	BL2
Q.4(b)	What is Hall effect? Obtain the Hall coefficient for an n-type semiconductor.	[5]	CO4	BL5
Q.5(a)	Explain Meissner effect. Differentiate between type I and type II superconductors using the Meissner effect.	[5]	CO5	BL2
Q.5(b)	What is a Cooper pair? How does it explain the phenomenon of superconductivity in type I superconductors?	[5]	CO5	BL2

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