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

CLASS: IMSC/MSC **SEMESTER : VIII/II**
BRANCH: PHYSICS **SESSION : SP/2025**

SUBJECT: PH411 CONDENSED MATTER 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)	How many types of Bravais Lattices are there? Write about the lattice parameters for five of them.	[5]	01	BL01
Q.1(b)	Iodine has an orthorhombic unit cell for which the a, b, and c lattice parameters are 0.481, 0.720, and 0.981 nm, respectively. If the atomic packing factor and atomic radius are 0.547 and 0.177 nm, respectively, determine the number of atoms in each unit cell.	[5]	01	BL05
Q.2(a)	Considering a free electron gas in one dimension, develop the expression for Fermi energy.	[5]	02	BL03
Q.2(b)	Develop the theory of Kronig Penney Model to explain the origin of bandgap, briefly.	[5]	02	BL03
Q.3(a)	What is Jahn-Teller effect? What would be the nature of Jahn-Teller distortion in $[Fe(CN)6]^{3-}$?	[5]	03	BL05
Q.3(b)	State the basic principle of NMR spectroscopy. Compare NMR and ESR in terms of operating principles, the nature of the species studied, and typical applications.	[5]	03	BL02
Q.4(a)	Derive the Clausius-Mossotti relation expressing the relationship between dielectric constant and atomic polarizability.	[5]	04	BL04
Q.4(b)	What are ferroelectric crystals? Classify the types of ferroelectric crystals.	[5]	04	BL02
Q.5(a)	Write a short note on Meissner effect.	[5]	05	BL02
Q.5(b)	Give a qualitative description of the BCS theory. How does it account for the superconducting state?	[5]	05	BL02

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