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

CLASS: IMSc/MSc/Pre-PhD   SEMESTER : VIII/II/I
BRANCH: Physics   SESSION : SP/2023

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)	What is meant by crystal symmetry? Explain any two types of symmetry with a suitable diagram.	[5]	1	2
Q.1(b)	The lattice parameters of a unit cell is 1.6Å, 2.22Å and 1.84Å. A plane having Miller indices of (2 3 1) makes an intercept of 1.84Å along the z-axis. Find the length of the intercept made by the plane along x and y-axis.	[5]	1	1
Q.2(a)	Discuss the wave-mechanical treatment of an electron confined in a one-dimensional box.	[5]	2	2
Q.2(b)	Explain the formation of the band using the Kronig-Penney model.	[5]	2	2
Q.3(a)	What is magnetic susceptibility? Discuss the classification of magnetic materials on the basis of magnetic susceptibility.	[5]	3	2
Q.3(b)	Derive an expression for magnetization of paramagnetic materials using Langevin theory.	[5]	3	3
Q.4(a)	What is meant by local field in a solid dielectric? Deduce an expression for the local field in a solid dielectric and hence obtain the Clausius-Mosotti relation.	[5]	4	2
Q.4(b)	Ar gas contains 2.7×10^{25} atoms m^{-3} at 0ºC and at 1 atmospheric pressure. Calculate the dielectric constant of Ar gas at this temperature if the diameter of the Ar atom is 0.384nm.	[5]	4	1
Q.5(a)	What is superconductivity? Discuss Type-I and Type-II superconductors.	[5]	5	2
Q.5(b)	Explain the BCS theory of superconductivity.	[5]	5	2