

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

CLASS: IMSC
BRANCH: PHYSICS

SEMESTER : V
SESSION : MO/2025

SUBJECT: PH302R2: SOLID STATE PHYSICS

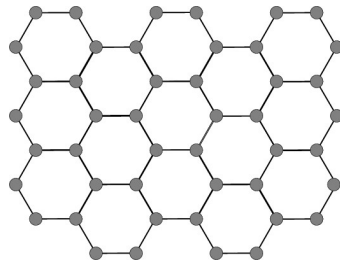
TIME: 02 Hours

FULL MARKS: 25

INSTRUCTIONS:

1. The question paper contains 5 questions each of 5 marks and total 25 marks.
 2. Attempt all questions.
 3. The missing data, if any, may be assumed suitably.
 4. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates
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|--------|--|-----|----|----|
| Q.1(a) | Differentiate between Primitive and non-primitive translation vectors. | [2] | CO | BL |
| Q.1(b) | Graphene is a 2d lattice in which sp^2 -hybridized carbon atoms are arranged as follows: | [3] | 01 | 02 |
| | | | 01 | 05 |



What is the Bravais lattice of graphene? How many atoms are there in a primitive unit cell?

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|--------|---|-----|----|----|
| Q.2(a) | Calculate the angles that the $[111]$ direction of a cubic lattice makes with the $[100]$ and $[110]$ directions. | [2] | 01 | 02 |
| Q.2(b) | Find the reciprocal lattice of an FCC lattice. | [3] | 01 | 03 |
| Q.3(a) | What are Phonons? | [2] | 02 | 01 |
| Q.3(b) | Differentiate between the optical and acoustical branches of a diatomic linear lattice. | [3] | 02 | 03 |
| Q.4(a) | What is Debye T^3 law? | [2] | 02 | 01 |
| Q.4(b) | How does the Debye model differ from the Einstein model of lattice heat capacity? | [3] | 02 | 02 |
| Q.5(a) | Define the Curie law of Paramagnetism. | [2] | 03 | 01 |
| Q.5(b) | Distinguish between the characteristic features of diamagnetism and paramagnetism. | [3] | 03 | |

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