

2020/TDC/ODD/SEM/
PHSH-502/098

(2)

TDC Odd Semester Exam., 2020
held in July, 2021

PHYSICS
(Honours)

(5th Semester)

Course No. : PSHH-502

(Condensed Matter Physics)

Full Marks : 35
Pass Marks : 12

Time : 2 hours

The figures in the margin indicate full marks
for the questions

Answer **five** questions, selecting **one** from each Unit

UNIT—I

1. (a) What are Miller indices? How are they determined? 1+2=3
- (b) Distinguish between point groups and space groups. Show that in a cubic lattice the distance between the successive planes of indices (hkl) is given by

$$d_{hkl} = \frac{a}{(h^2 + k^2 + l^2)^{1/2}} \quad 1+3=4$$

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(Turn Over)

2. (a) Discuss the measurement of lattice parameters using Bragg's law. 4
- (b) Explain the origin of Laue's spot. 3

UNIT—II

3. Explain the term 'binding energy'. How would you calculate the binding energy for an ionic crystal having NaCl structure? 2+5=7
4. Discuss in brief (a) van der Waals' bonding and (b) hydrogen bonding. 7

UNIT—III

5. Derive an expression for the frequency of lattice vibration of a diatomic lattice chain. What are the optical and acoustical branches? 5+2=7
6. (a) Discuss Hall effect. Explain how the measurement of Hall coefficient helps one to determine the sign of charge carrier. 3+2=5
- (b) Discuss the failure of free-electron theory with reference to Hall effect. 2

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(Continued)

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UNIT—IV

7. State and prove Bloch theorem under periodic potential. 2+5=7

8. (a) Prove that effective mass of an electron is

$$m = \hbar^2 \left/ \frac{d^2 E}{dK^2} \right. \quad 4$$

(b) Discuss the formation of donor level in n -type semiconductor with the help of energy-level diagram. 3

UNIT—V

9. (a) Discuss London's theory of superconductors. What is London penetration depth? 3+2=5

(b) Give a brief qualitative idea of BCS theory. 2

10. Define liquid crystals. Discuss in brief the classification of liquid crystal. What are the uses of liquid crystal? 1+4+2=7

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