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B.Sc./3rd Sem (H)/PHSH/22(CBCS)

2022

3rd Semester Examination

PHYSICS (Honours)

Paper : GE 3-T

[Solid State Physics]

[CBCS]

Full Marks : 40

Time : Two Hours

The figures in the margin indicate full marks.

*Candidates are required to give their answers
in their own words as far as practicable.*

Group - A

Answer any **five** of the following questions : $2 \times 5 = 10$

1. What are Miller indices ? What is their importance ?
2. What is phonon ? Give an evidence for the existence of phonons.
3. Explain the term 'Hysteresis' in the contexts of magnetism of solids.
4. Give the Curie law of paramagnetism. What is Curie temperature ?
5. Conductivity of metals decreases while that of semiconductor increases with rise in temperature. Explain.

P.T.O.

6. Lead in the superconducting state has critical temperature of 6.2 K at zero magnetic field and critical field of 0.064 Am^{-1} at 0 K. Determine the critical field at 4 K.
7. Explain the Bragg's law for x-ray diffraction in crystals.
8. How does the paramagnetic susceptibility of a substance vary with temperature ?

Group - B

Answer any **four** of the following questions : $5 \times 4 = 20$

9. Determine the values of packing fraction for *fcc*, *bcc* and *sc* structures. 5
10. Obtain an expression for diamagnetic susceptibility using Langevin's theory. 5
11. What is Meissner effect ? Explain the difference between type I and type II superconductors using the Meissner effect. 1+4
12. What is Hall effect ? Obtain the expression for Hall coefficient for a semiconductor material. 1+4
13. Distinguish between normal and anomalous dispersion. 5
14. Draw the variation of energy, velocity and effective mass of an electron in a solid as function of *K*. Explain the concept of Energy band. 3+2

Group - C

Answer any *one* of the following questions :

10×1=10

15. Describe the Einstein model of lattice heat capacity.
Discuss the success and failures of this model. 7+3

16. (i) Derive the Clausius-Mossotti relation expressing the relation between dielectric constant and atomic polarizability.

(ii) Using Kronig Penny model, show that for $p \ll 1$

the energy for the lowest band is $E = \frac{\hbar^2 p}{ma^2}$. 6+4

বঙ্গানুবাদ

বিভাগ - ক

নীচের যেকোন পাঁচটি প্রশ্নের উত্তর দাও : ২×৫=১০

- ১। মিলার সূচক কি ? তাদের গুরুত্ব কি ?
- ২। ফোনন কি ? ফোননের অস্তিত্বের প্রমাণ দাও।
- ৩। কঠিন পদার্থের চুম্বকত্বের প্রসঙ্গে 'হিস্টেরেসিস' শব্দটি ব্যাখ্যা কর।
- ৪। প্যারাম্যাগনেটিজমের কুরি সূত্র লেখো। কুরি তাপমাত্রা কি ?
- ৫। তাপমাত্রা বৃদ্ধির সাথে ধাতুর পরিবাহিতা হ্রাস পায় কিন্তু অর্ধপরিবাহীর পরিবাহিতা বৃদ্ধি পায়। ব্যাখ্যা কর।

P.T.O.