বিদ্যাসাগর বিশ্ববিদ্যালয়

VIDYASAGAR UNIVERSITY

Question Paper

B.Sc. Honours Examinations 2021

(Under CBCS Pattern)

Semester - V

Subject : PHYSICS

Paper : C 12-T & P

Full Marks : 60 (Theory - 40 + Practical - 20)

Time : 3 Hours

Candidates are required to give their answers in their own words as far as practicable.
The figures in the margin indicate full marks.

[SOLID STATE PHYSICS]

(Theory : Marks - 40)

Group-A

A. Answer any *three* of the following questions : **12×3=36**

1. (a) What are symmetry operators?

   (b) Describe the principal symmetry operations applicable to a 3-D lattice.

   (c) Show that the five fold rotational axis is not permissible in case of lattice.

4+4+4

2. (a) Show that the zero point energy of a solid according to the Debye Model is $\frac{9}{8}R\theta_D$.

(b) The Debye temp of diamond is 2000K. Calculate the mean velocity of sound in Diamond. Given the density and atomic mass of Diamond as 3500 kg m^{-3} and 12 amu respectively, if the interatomic spacing is 1.54Å, estimate the frequency of the dominant mode of lattice vibration. 6+6

3. (a) Discuss the formation of allowed and Forbidden energy Bands on the basis of Kronig-Penney model. Discuss the extreme conditions when energy levels are either discrete or continuous.

(b) What is the effect of changing in the binding energy of electrons on the energy bands? 6+6

4. (a) Give a qualitative description of the BCS theory.

(b) How does it account for the superconducting state? 6+6

5. (a) Determine frequency of the a/c current flows through a Josephson junction across which a d.c voltage of 0.5 mV is applied.

(b) The critical temperature of a superconductor at zero magnetic field is T_C. Determine the temperature at which the critical field becomes half of its value at 0 K. 6+6

6. (a) Describe the characteristic properies of ferroelectric materials.

(b) What is meant by Polarisation catastrophe?

(c) Derive the Clausius-Mossotti relation. Expressing the relationship between dielectric constant and atomic polarizability. 4+2+6

Group-B

B. Answer any *two* of the following questions : 2×2=4

7. What is superconductivity?

8. What is Forbidden energy gap?

9. What are Brillouin zones?

10. Define the geometrical structure factor.

(Practical)

Group-A

A. Answer any *one* of the following questions : 15×1=15

1. (i) What do you mean by Magnetic susceptibility of solids?

   (ii) How you can measure Magnetic Susceptibility of solid by Gouy method. Mention all steps, Working Formula and Diagram, method. 1+14

2. (i) What is Hall effect and Hall coefficient?

   (ii) Mention all the steps and method to determine the Hall coefficient of a semiconductor. 4+11

3. Discuss Quinck's tube method to measure method magnetic susceptibility of paramagnetic sample. 15

Group-B

B. Compulsory Questions : (Answer any *one* question) 5×1=5

4. (i) What is resistivity of semiconductor and band gap of semiconductor? 5

   (ii) Determine the dielectric constant of a material with frequency.

OR

Laboratory note-Book / Viva-Voice. 5

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