TM243332L

Reg. No :.....

Name :.....

MASTER'S DEGREE (C.S.S) EXAMINATION, NOVEMBER 2024

2023 ADMISSIONS REGULAR

SEMESTER III PHYSICS - ELECTIVE COURSE

PH3E01TM20 - Solid State Physics for Materials

Time : 3 Hours **Maximum Weight : 30**

Part A

I. Answer any Eight questions. Each question carries 1 weight **(8x1=8)**

1. Compare Schottky and Frenkel imperfections.
2. Outline the classification of crystal defects.
3. Summarise the features of elastic and plastic deformations in a crystal.
4. Even though the Madelung constant is a function of crystal structure, the Madelung potential of ionic crystals is independent of crystal structure. Why?
5. What are the roles of attractive and repulsive forces in the formation of solids?
6. Give a detailed account of polariton. Sketch the dispersion curves for the uncoupled phonons and photons. .
7. Discuss the various methods to measure the binding energy of the excitons.
8. State the relevance of Einstein's equation in diffusion.
9. Give a detailed interpretation of the phase diagram of water.
10. Explain the reason for the reduction of spontaneous magnetisation in a ferromagnet.

Part B

II. Answer any Six questions. Each question carries 2 weight **(6x2=12)**

11. In a sc crystal system with a =3 Å, a positive edge dislocation of length 1 mm, climbs down by 1 μm. How many vacancies are lost or created?
12. Calculate the number of vacancies per cubic meter in iron at 850°C. The energy for vacancy formation is 1.08 eV/atom. Furthermore the density and atomic weight of Fe are 7.65 g/cm^3 and 55.85 g/mol respectively.
13. Outline the salient features of covalent bonding.
14. Distinguish between hydrogen bonding and Vander Waals bonding.
15. Give a concise method to obtain polariton dispersion relation.
16. Outline the formation of electron hole drops.
17. Write short notes on allotropy, polymorphism and polytypism.
18. Briefly explain the conditions for the formation of transverse and longitudinal mode of oscillations in a plasma medium.

Part C

III. Answer any Two questions. Each question carries 5 weight **(2x5=10)**

19. Distinguish between perfect and imperfect dislocations. Explain how these are related to dislocation energy.
20. Elaborate on cohesive energy of ionic crystals and derive an equation for lattice energy.
21. Explain quantization of spin waves. Generate the dispersion relation for Magnons.
22. Discuss the unidirectional flow of matter in a binary system and derive Fick's first and second law. Provide the solution to these equations.