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TM243407J

Reg. No :.....

Name :.....

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

2020, 2021, 2022 ADMISSIONS SUPPLEMENTARY

SEMESTER III - ELECTIVE COURSE PHYSICS

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. Elaborate on right handed and left handed screw dislocations.
2. Describe how the movement of atoms in a crystal might be accomplished by the motion of vacancies. Could the same result be achieved by the movement of self interstitials? Why?
3. Distinguish between twist and tilt boundary.
4. Distinguish between directional and non directional bonds.
5. Discuss the features of crystals of inert gases.
6. Obtain the expressions for dielectric function of an electron gas.
7. Explain plasma oscillation and hence define Plasmon. How could you measure them?
8. Give an account on phase, components and variables of a system.
9. Outline close packing in simple cubic and bcc systems.
10. Define reflectivity coefficient and reflectance. Obtain an expression for it.

Part B

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

11. An fcc crystal has a CRSS of 0.7 MNm^{-2}. What tensile stress must be applied along the [100] direction of the crystal to initiate plastic deformation?
12. 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?
13. Explain the features of ionic bonding and obtain bond dissociation energy of NaCl.
14. Discuss the forces between atoms and deduce the condition for equilibrium in terms of inter atomic distance.
15. Derive an expression for Plasma frequency. Does the plasma frequency has anything to do with plasmons?
16. Derive LST relation. Explain its importance?
17. Derive equations for size and coordination of voids in three dimensions.
18. Compare the diffusivities of hydrogen, nitrogen and nickel in iron at 300 K and explain the difference among these values.

Part C

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

19. Write an essay on Dislocation motion, dislocation reaction and dislocation energy. Deduce an equation for concentration of point imperfections in the case of vacancy.
20. Derive the equation $$U = \frac{287.2 Z_c Z_a}{(r_c + r_a)} \left\{ 1 - \frac{0.345}{(r_c + r_a)} \right\}$$
21. Give an account of Magnon and derive Bloch $T^{3/2}$ law.
22. Generate an expression for Kramers Kronig relation. Discuss its important application .