MSc DEGREE (CSS) EXAMINATION , JANUARY 2022

Second Semester

CORE - PH010204 - CONDENSED MATTER PHYSICS

M Sc PHYSICS,M.Sc.SPACE SCIENCE

2019 Admission Onwards

71A50ED3

Time: 3 Hours   Weightage: 30

Part A (Short Answer Questions)

*Answer any **eight** questions.*

*Weight **1** each.*

1. What is meant by "atomic radii" in a crystal?

2. Why cannot we use ordinary optical grating for x ray diffraction?

3. Write note on point group and space groups.

4. State and explain Mathiessen's rule for electrical resistivity in metals.

5. What changes do you expect from an electrons obeying Bloch functions from an electron in nearly free electron model?

6. With a neat diagram explain variation of effective mass of an electron with wave vector k

7. What is the physical significance of shape of dispersion relations?

8. State and Explain Hund's Rule.

9. Define Bloch wall in a crystal.

10. Briefly explain magnetic force microscopy.

(8×1=8 weightage)

Part B (Short Essay/Problems)

*Answer any **six** questions.*

*Weight **2** each.*

11. Derive the reciprocal lattice to SC lattice.

12. The density of Zn is 7.13x103 kg/m3 and its atomic weight is 65.4 Calculate the fermi energy in Zinc. Also calculate the mean energy at 0K. The effective mass of electron in zinc is 0.85me

13. At what temperature we can expect a 10% probability that the electrons in silver have an energy which is 1% above the fermi energy. The Fermi energy of silver is 5.5 eV.

14. A specimen of germanium is doped with 0.01% arsenic. Assuming that all arsenic atoms are ionized,calculate electron and hole density in germanium. Given that Density of germanium atom is $4.41 \times 10^{28}/m^3$ and arsenic carreir density in germanium in room temperature is $2.37 \times 10^{19}/m^3$

15. What do you understand by Phonon ? Express laws of conservation of energy and momentum in case of inelastic scattering of phonons by photon

16. What is the Debye frequency for Copper, if its Debye temperature is 315 K? Also find the Debye specific heat at 10 K and 300 K.

17. The Curie temperature of iron is 1043 K.Assume that iron atoms, when in metallic form have moments of 2 Bohr magneton per atom Iron is body centred cubic with lattice parameter a=0.286 nm.Calculate a)Saturation magnetization b) Curies Constant c) Weiss field constant

18. Derive BlochT3/2 law.

(6×2=12 weightage)

Part C (Essay Type Questions)

*Answer any **two** questions.*

*Weight **5** each.*

19. On the basis of free electron theory derive an expression for electrical and thermal conductivity of metal and conductivity of metal and hence establish Widemann-Franz- Lorentz law

20. Discuss and get an expression for the motion of electron in a periodic potential assuming electron obeys Bloch function.

21. Bring out the validity of Debye model.

22. Derive the dispersion relation of antiferromagnetic magnons.

(2×5=10 weightage)