Register Number:
Date:

ST. JOSEPH'S COLLEGE (AUTONOMOUS), BANGALORE-27

M.Sc. PHYSICS - III SEMESTER

SEMESTER EXAMINATION: OCTOBER 2019

PH 9218 – SOLID STATE PHYSICS

Time- $2\frac{1}{2}$hrs **Max Marks-70**

This paper contains TWO printed pages and 2 parts

PART – A

Answer any FIVE. Each question carries 10 marks.

[5 x 10 = 50]

1. What is density of states in metals? Derive an expression for density of energy states and hence obtain fermi energy of a metal. (2+8)
2. Derive the London equations and explain the term coherence length.
3. What is meant by local field in a solid dielectric? Deduce an expression for the local field for structures possessing cubic symmetry. (2+8)
4. Distinguish between Diamagnetic, paramagnetic and ferromagnetic properties of materials with neat diagrams.
5. Define Hall Effect. With neat sketch discuss the theory of Hall Effect in the case of a semiconductor. Mention the application of Hall Effect based on the results. (2+6+2)
6. (a) What are Laue spots?. Describe the Laue's method of determination of crystal structure.
   (b) Why do the X-ray diffraction lines observed from small grains become broadened?. (7+3)
7. (a). Discuss in detail different types of solid based on order and crystallinity.
   (b). What are Miller indices?. Draw the (100), (110) and (111) planes corresponding to a cubic crystal. (5+5)

PART – B

Answer any FOUR. Each question carries 5 marks.

[4 x 5 = 20]

8. Explain electronic polarization and orientational polarization in dielectric with suitable diagram.

9. The London penetration depths for Lead (Pb) at 3K and 7.1K are 39.6 nm and 173 nm respectively. Calculate its superconducting transition temperature as well as its penetration depth at 0K.
10. Compute the energy difference between the first and second quantum states for a free electron in a solid of size 1 m^3. If the energy of the electron in the second energy level is equal to average energy of the molecules of perfect gas, find the temperature of that electron.
11. Describe Hysteresis loop. How is it used to classify the magnets?
12. Obtain the Debye frequency (ν_D) and minimum wavelength using Debye's approximation expression. If N/V=10^{28} per m^3 and velocity of sound is ≈1000m/s.
13. Find the concentration of holes and electrons in P –type and N-type silicon at 300K. If the conductivity is 3 x 10^4 $\Omega^{-1}m^{-1}$.