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. Explain different types of crystal defects. Discuss point defects in detail with necessary diagrams and mention its applications in solids. (5+5)
2. Obtain Clausius - Mossotti equation and explain how it can be used to determine the dipole moment of polar molecule from the dielectric constant measurements. (8+2)
3. Define Meissner effect. Explain the different type of superconductors based on transition temperature and critical magnetic field with necessary graph. (2+8)
4. Discuss the concept of ferromagnetism. Explain Weiss theory of ferromagnetism in detail to find the spontaneous magnetization under critical temperature. (10)
5. Explain the electron in one-dimensional periodic potential using the Kronig-Penney model. (10)
6. Obtain the expression for the specific heat capacity of solids using Einstein's theory. Discuss the variation of specific heat capacity of solids with temperature. (10)
7. Define Fermi energy. Describe about the Energy Band Diagram of conductors, semiconductors and insulators. How can we determine whether a semiconductor is direct band gap or indirect band gap? (2+6+2)

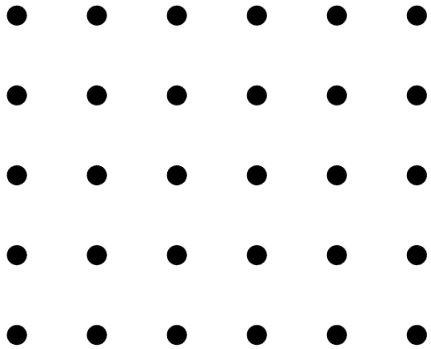
PART – B

Answer any FOUR. Each question carries 5 marks.

[4 x 5 = 20]

8. A capacitor uses aluminum oxide as the dielectric with relative permittivity as 8. An effective surface area of 360 cm^3 gives a capacitance of 6 μF. Calculate the field strength and the total dipole moment induced in the oxide layer, if a potential difference of 15 V exists across the capacitor.

9. For a pan used to heat water on burner, explain the use of different materials in making the pan based on the concept of specific heat.
10. What is meant by critical temperature and critical magnetic field?. The superconducting transition temperature of Lead is 7.26K. The initial field at 0K is 64 x 10^3 ampere/meter. Calculate the field at 5K. (3+2)
11. Prove that the reciprocal lattice of FCC is the primitive of BCC lattice. (5)
12. What is Brillouin zone?. Construct Wigner-Seitz cell for the given 2D lattice. Mention the steps to identify the Wigner-Seitz cell. Show the first three Brillouin Zones for the 2D lattice. (2+3)



13. A beam of X-ray of wavelength (λ=0.842Å is incident on a crystal at (glancing) angle of 8.35°, when the first order Bragg's reflection occurs. Calculate the angle for third order reflection.