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GIET UNIVERSITY, GUNUPUR – 765022
M. Sc. (Third Semester) Examinations, December – 2022
20PHPC304 – Condensed Matter and Materials Physics-1
(Physics)

Time: 3 hrs

Maximum: 70 Marks

(The figures in the right hand margin indicate marks.)

PART – A**(2 x 10 = 20 Marks)****Q.1. Answer ALL Questions**

	CO#	Bloom Level
a. Discuss the properties of X-ray?	CO1	K1
b. Show that in form factor $\int_0^\pi e^{i\mu r \cos\phi} \sin\phi d\phi = \frac{2\sin\mu r}{\mu r}$.	CO1	K2
c. Discuss various types of bonding in solids?	CO1	K1
d. The critical temperature of Hg with an isotopic mass of 197.5 is 4.29 K. What will be its critical temperature when its isotopic mass increased to 201.4?	CO2	K2
e. Differentiate between crystalline and amorphous solids?	CO2	K1
f. Lead in the superconducting state has critical temperature of 6.2 K at zero magnetic field and a critical field of 0.064 Mam ⁻¹ at 0 K. Determine the critical field at 4 K.	CO2	K2
g. What is Widemann-Franz law?	CO3	K1
h. How to construct Wigner-Seitz unit cell?	CO3	K1
i. Why superconductors behave like perfect diamagnetic material?	CO4	K1
j. Define Miller Indices of a crystal?	CO4	K1

PART – B**(10 x 5 = 50 Marks)**Answer ANY FIVE the questions

	Marks	CO#	Bloom Level
2. a. What is Josephson effect? Derive the equation for an DC Josephson effect?	6	CO1	K1
b. Discuss the steps for Miller Indices of a crystal?	4	CO1	K1
3.a. Discuss the thermodynamic properties of a superconductor?	7	CO1	K1
b. X-ray of wavelength $\lambda=a$ reflected from (111) plane of a simple cubic lattice. If lattice constant is “a” then calculate the Bragg angle?	3	CO1	K2
4. a. Derive an expression for the dispersion relation of monoatomic lattice?	5	CO2	K1
b. What is penetration depth? Derive an expression of 2 nd order differential penetration depth equation in terms of magnetic field?	5	CO2	K1
5.a. Derive an expression for the dispersion relation of diatomic lattice?	6	CO2	K1
b. What is flux quantization? Derive a mathematical expression of flux quantization?	4	CO2	K1
6. a. Write short note on Bragg’s law of diffraction?	4	CO3	K1
b. Discuss in detail about the e ⁻ -phonon-e ⁻ interaction in terms of Feynman diagram?	6	CO3	K1
7.a. Derive London 1 st and 2 nd equation for a superconductor?	7	CO3	K1
b. Write the structure factor Intensity value of a SC, BCC and FCC crystal lattice?	3	CO3	K1
8. a. What is Meissner effect? Discuss about Type-1 and Type-2 superconductor?	5	CO4	K1
b. Derive an expression for Kronig-Penny model of solids?	5	CO4	K1

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