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**GIET UNIVERSITY, GUNUPUR - 765022**  
M. Sc. (Third Semester) Examinations, December - 2023  
**22PHPE304 - Condensed Matter & 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 <i>ALL</i> questions	CO #	Blooms Level
a. Write momentum and energy conservation relation in inelastic scattering of phonons.	CO1	K1
b. Based on Debye model discuss the T dependence of $C_V$ .	CO1	K2
c. If $\omega^2(k) = \omega_0^2(3 - \cos k_x a - \cos k_y a - \cos k_z a)$ , velocity ( $v_g$ ) = ?	CO1	K3
d. Write down the different contributions to Hartee's potential.	CO2	K2
e. Show that superconductor acts as perfect diamagnet.	CO3	K3
f. A superconducting tin has a critical temp. of 3.7K at zero magnetic field and a critical field of 0.0306T at 0K. Find the critical field at 2 K.	CO3	K2
g. What is coherence length?	CO3	K1
h. Write the principle of SQUID.	CO4	K1
i. What is vortex state of a superconductor?	CO4	K2
j. What is isotope effect?	CO4	K3

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

	Marks	CO #	Blooms Level
2. a. Describe the Einstein's model of lattice heat capacity.	8	CO1	K1
b. Discuss failure of Einstein's model.	2	CO1	K2
3.a. What is Hartee-Fock approximation? Discuss Jellium model to solve Hartee-Fock equation.	8	CO2	K2
b. How Jellium model differ from free electron model.	2	CO2	K2
4. a. Obtain an expression the frequency of phonon generated when a photon is scattered inelastically at an angle $\theta$ .	8	CO1	K2
b. The visible light of wave length $5000\text{\AA}$ undergoes scattering from a crystal of refractive index 1.5. Calculate the maximum frequency of the phonon generated.	2	CO1	K3
5.a. Derive the London's penetration depth using London's equations.	8	CO3	K1
b. What is the relation between $\lambda$ and $\xi$ for type-I and Type-II SC.	2	CO3	K2

6. a.	Discuss the theory proposed by Bardeen-Cooper- Schrieffer for SC.	8	CO3	K2
b.	What is Cooper pair?	2	CO3	K1
7.a.	Discuss BCS ground state based on microscopic theory of SC.	8	CO4	K2
b.	What is a fluxoid in SC?	2	CO4	K2
8. a.	Explain the difference between type-I and type-II superconductor. What is Meissner effect?	8	CO3	K2
b.	Based on Meissner effect state the magnetic nature of superconductor.	2	CO3	K1