GANDHI INSTITUTE OF ENGINEERING AND TECHNOLOGY UNIVERSITY, ODISHA, GUNUPUR
(GIET UNIVERSITY)

M.Sc. (Third Semester - Regular) Examinations, December – 2024
22PHPE304– Condensed Matter and Materials Physics-I
(M.Sc.- 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 #	Blooms Level
a.	Graphically show dispersion relations for linear diatomic lattice.	CO1	K1
b.	The visible light of wave length 5000Å undergoes scattering from a crystal of refractive index 1.5. Calculate the maximum frequency of the phonon generated.	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.	What is the contribution to H in Hartee's approximation method?	CO2	K2
e.	Prove χ = -1 in superconductor.	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 vortex state of a superconductor?	CO3	K1
h.	Write the momentum and spin of Cooper pair.	CO4	K1
i.	Define kappa interms of λ and ξ, classify the SC on this basis.	CO4	K2
j.	Write the expression for phonon thermal conductivity.	CO1	K2

PART – B	**(10 x 5 = 50 Marks)**

Answer *ANY FIVE* questions

		Marks	CO #	Blooms Level
2. a.	Obtain an expression the frequency of phonon generated when a photon is scattered inelastically at an angle θ.	8	CO1	K1
b.	Define U-process of phonon scattering.	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.	Describe the Einstein model of lattice heat capacity.	8	CO1	K2
b.	Write the assumption of Debye Continuum model.	2	CO1	K3
5.a.	Derive the London's penetration depth using London's equations.	8	CO3	K1
b.	Write the relation between λ and ξ 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.	Define Cooper pair.	2	CO3	K1

7.a.	Discuss BCS ground state based on microscopic theory of SC.	8	CO4	K2
b.	Define flux quanization in SC.	2	CO4	K2
8. a.	Give an account of Thermodynamics of Superconductivity.	8	CO3	K2
b.	Find I_C of a wire if it has diameter 1mm at 4.2K, T_C=7.18K, $H_C(0)$ = 6.5×10^4A/m	2	CO3	K1