Registration No.: | | | | | | | | | | |

Total Number of Pages: 02

Course: M.Sc.I
Sub_Code: FPYE904

9th Semester Regular Examination: 2024-25
SUBJECT: CONDENSED MATTER PHYSICS-I
BRANCH(S): M.Sc.I.(AP)
Time: 3 Hours
Max Marks: 70
Q.Code: R157

Answer Question No.1 (Part-I) which is compulsory, any five from rest (Part-II)
The figures in the right-hand margin indicate marks.

Part-I

Q1 **Answer the following questions:** **(2 x 10)**

a) Discuss the structure of Brillouin zones.
b) What is Fermi surface? What is its significance?
c) Mention the outcomes of tight binding approximation.
d) What is effective mass of electron? Under what conditions the effective mass of an electron becomes positive, negative, and infinity?
e) What are plasmons?
f) Briefly explain dielectric loss.
g) How Bloch theorem is an important tool in understanding the band theory of solids?
h) Silicon has electron and hole concentration $n_0 = p_0 = n_i = 1.0 \times 10^{16}/m^3$. Calculate the Hall co-efficient of Si.
i) What is drift velocity?
j) Differentiate between classical and quantum Hall effect.

Part-II

Long Answer Type Questions (Answer Any five)

Q2 Write the wave equation for electron in a periodic potential. Explain formation of energy gap in solid using nearly free electron approximation theory. **(10)**

Q3 What are Brillouin zones? How is it constructed? Describe and sketch the first Brillouin zone of BCC and FCC lattices. Mention their importance in crystal analysis. **(10)**

Q4 **a)** What is Kohn effect? Derive expression for dielectric constant and show the variation of screening parameter with wave number graphically to explain Kohn effect. **(6+4)**

b) State and explain Friedel Sum rule?

Q5	**a)**	Derive Lindhand's expression for determination of dielectric function of an Interacting electron gas.	**(5+5)**
	b)	What is Static screening? Derive Debye-Hucked formula.	
Q6	**a)**	Derive Boltzmann transport equation.	**(5+5)**
	b)	Employing Boltzmann transport equation, find an expression for the electronic thermal conductivity of metals.	
Q7	**a)**	Derive an expression for two band magneto resistance model and give its importance.	**(5+5)**
	b)	Prove thermoelectric effects from transport theory.	
Q8		Write short notes on any two	**(5+5)**
	a)	Tight binding approximation	
	b)	De Hass van Alphen effect	
	c)	Quantum Hall effect	