QP Code: RJ22MSC085 | Reg. No | | | | | | | | | | | AR 22

GIET UNIVERSITY, GUNUPUR – 765022

M. Sc (Second Semester) Examinations, July – 2023

22PHPC203 - Basic Solid State Physics (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.	What is binding energy? Write the relation and how it varies with interatomic distances.	CO1	K1
b.	Draw the dispersion relation for linear diatomic lattice showing acoustical and optical modes.	CO1	K1
c.	Define the fermi -Dirac distribution function.	CO2	K1
d.	Give the expression for density of state in metal.	CO2	K1
e.	What do you understand by the effective mass of an electron? Explain its significance.	CO3	K1
f.	Discuss the limitations of Debye model.	CO2	K1
g.	Discuss the applications of pyroelectric materials.	CO4	K1
h.	What is compensated semiconductors?	CO4	K1
i.	Prove that for Kroning penny model potential p $<<1$ energy of the lowest energy band at k=0 is $E=P\hbar^2/ma^2$.	CO4	K2
j.	What are point defects and line defects?	CO4	K1

PART – B **(10 x 5 = 50 Marks)**

Answer ***ANY FIVE*** questions

		Marks	CO #	Blooms Level
2.	Give account of an ionic, covalent, metallic bindings in crystal with examples.	10	CO1	K2
3.a.	The net potential energy U_0 between adjacent atoms may sometimes be represented as a function of the interatomic distance r according to the relation $U(r)= -\frac{a}{r^m}+\frac{b}{r^n}$ in which a, b, m, and n are all constants. Calculate the binding energy U_0 in terms of the parameters a, b, m, and n using the following procedure Differentiate U(r) with respect to r, then set the resulting expression equal to zero, since the curve of U(r) versus r is minimum at U_0. Solve for r in terms of a, b, m, and n which yields r_0, the equilibrium interatomic spacing. Get the expression for U_0 by substituting r_0 in the equation for $U(r)$.	8	CO1	K2

b.	Explain the effect of temperature on the Fermi -Dirac distribution function.	2	CO2	K2
5.	Discuss the Kronig-Penny model for the motion of an electron in a periodic potential	10	CO3	K1
6.	Discuss about ionic and orientational polarization.	10	CO4	K1
7.	Discuss the statistics of donors and acceptors representing the freeze- out and complete ionization condition.	10	CO4	K2
8. a.	Calculate the density of electron (n_o) in conduction band in a intrinsic semiconductor in equilibrium condition.	8	CO4	K2
b.	Draw the energy level diagram indicating the conduction band, valence band, fermi level, and doner level of a n-type semiconductor	2	CO4	K1

-

-- End of Paper ---