


Name:		 UPES <small>UNIVERSITY WITH A PURPOSE</small>
Enrolment No:		

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Term Examination, June 2021

Course: Solid State physics
Program: B.Sc H (Mathematics, Chemistry & Geology)
Course Code: PHYS1019

Semester: II
Time 03 hrs.
Max. Marks: 100

SECTION A

- 1. Each Question will carry 5 Marks**
- 2. Instruction: Complete the statement / write the correct answer(s)**

S. No.	Question	Marks	CO
Q 1	A) What do you understand by miller indices? Write its important features.	3	CO1
	B) The co-ordination number of FCC is: i) 2 ii) 4 iii) 6 iv) 12	2	
Q2	A) Define reciprocal lattice vector and write its properties.	2	CO1
	B) If x-ray of wavelength 1.64 \AA is incident on a single cubic crystal of lattice constant 4 \AA , find the angle for 2 nd order i) 10 \AA ii) 24 \AA iii) zero iv) None	3	
Q3	A) A phonon is emitted or absorbed in i) elastic scattering of a photon by a crystal ii) inelastic scattering of a photon by a crystal iii) both elastic and inelastic scattering of a photon by a crystal iv) None of the above	2.5	CO2
	B) The assumption that the atoms in a lattice are coupled together is taken into consideration for a variation of specific heat of solid is consider by i) Einstein ii) Debye iii) Newton iv) None of the above	2.5	
Q4	A) What do you mean by optical and acoustical Phonon?	2	CO2
	B) Find the Einstein temperature if the Einstein Frequency is $3 \times 10^{12} \text{ Hz}$ i) 0 K ii) 273 K iii) 144 K iv) None of the above	3	
Q5	A) Define of super conductivity and transition temperature.	3	CO4
	B) Magnetic lines of force cannot penetrate the body of a superconductor, this phenomenon is known as i) London theory ii) Meissner effect iii) Isotopic effect iv) BCS theory	2	
Q6	What do you mean by Type 1 and Type II superconductor? Write the difference between them.	5	CO4

SECTION B

- 1. Each question will carry 10 marks**
- 2. Attempt part A or part B of Question no. 11**

Q 7	What is atomic packing fraction? Calculate its value for Body Centered cubic structures. The height of HCP unit cell is 4.935 \AA , Calculate the volume of unit cell?	(7+3)	CO1
Q 8	Discuss the Langevin's classical theory of paramagnetism and derive the Langevin's function and Curie's Law by using the Langevin's classical theory of paramagnetism.	10	CO3
Q 9	Explain the Weiss theory of Ferromagnetism and derive the relation for susceptibility by using the Weiss theory.	10	CO3
Q 10	Discuss the Kronig-Penny model and show that how it explain the forbidden bands? Find the hole concentrations at $T = 300 \text{ K}$ where intrinsic concentration $n_i = 1.5 \times 10^{10} / \text{cm}^3$ for an n-type silicon for which the dopant concentration $N_D = 10^{17} / \text{cm}^3$	(7+3)	CO4
Q 11	A) Discuss the Debye's theory of lattice heat capacity and derive the T^3 Law. Or B) What do you mean by lattice vibrations? Derive the dispersion relationship for monoatomic one-dimensional lattice vibration.	10	CO2
Section C			
<ol style="list-style-type: none"> 1. Each Question carries 20 Marks 2. Instruction: Write Long answer 3. Attempt Question no. 12 or 13 			
Q 12	A) What do you mean by Polarization? Discuss and derive the relation for four types of polarization mechanisms. B) What do you mean by Normal and Anomalous Dispersion? Write and discuss the Cauchy's and Sellmeier's Relation. Or	(10 + 10)	CO4
Q 13	A) What do you mean by internal field in dielectric and derive the mathematical relation for it. B) Derive the Clausius Mossotti Equations for dielectric material.		