UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2022

Course: Solid State Physics   Semester: II
Program: B.Sc H (Mathematics & Geology)   Time   : 03 hrs.
Course Code: PHYS1019   Max. Marks: 100

SECTION A
(5Qx4M=20Marks)

S. No.	Question	Marks	CO
Q 1	What do you understand by miller indices? Write its important features.	4	CO1
Q 2	What do you understand by unit and primitive cell?	4	CO1
Q 3	What do you mean by Bragg's Law, write its mathematical form?	4	CO1
Q 4	Calculate the value of Lande Spliting factor (g) for the electrons which have only spin motion.	4	CO3
Q 5	Draw the Fermi energy level diagram of extrinsic semiconductors	4	CO4

SECTION B
(4Qx10M= 40 Marks)
Attempt one part of question no. 9

Q 6	What do you mean by atomic packing fraction? Calculate its value for Body Centered cubic structures. If x-ray of wavelength 1.64 A^0 is incident on a single cubic crystal of lattice constant $4A^0$, find the angle for 2nd order.	10	CO1
Q 7	Discuss the Debye's theory of lattice heat capacity and derive the T^3 Law.	10	CO2
Q 8	Discuss the Kronig-Penny model and show that how it explain the forbidden bands? Find the hole concentrations at T = 300 K where intrinsic concentration $n_i = 1.5 \times 10^{10}$ /cm^3 for an n-type silicon for which the dopant concentration $N_D = 10^{17}$/cm^3	10	CO4
Q 9	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. Or Explain the Weiss theory of Ferromagnetism and derive the relation for susceptibility by using the Weiss theory.	10	CO3

	SECTION-C **(2Qx20M=40 Marks)** 1. **Attempt one part from Question no. 11**		
Q 10	a) What are the assumptions of Einstein's theory of specific heats of solids? Obtain the mathematical relations for the same and discuss its behavior at very high and very low temperature. b) Derive the relation for four types of polarization mechanisms and analyze its behavior at different frequencies.	**(10+ 10)**	**CO2** **CO4**
Q 11	a) Derive the Clausius Mossotti Equation and deduce the equation for the specific polarization of dielectric. b) What do you mean by superconductivity and write its important properties? Describe the effect of external magnetic field on the superconducting state of material. **Or** a) Explain the local field in dielectric material and derive the mathematical relation for it. b) What do you mean by the Meissner effect? How does it help in classifying different types pf superconductors?	**(10 +10)**	**CO4** **CO4**