JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -2 EXAMINATION- 2024

M.Sc-III Semester (Physics)

COURSE CODE (CREDITS):18MS1PH313 MAX. MARKS: 25

COURSE NAME: Advance Solid state-II

COURSE INSTRUCTORS: SKT MAX. TIME: 1 Hour 30 Minutes

Note: *(a) All questions are compulsory.*

(b) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems

Q.No	Question	CO	Marks
Q1	Prove that the stationary states of the orbital Schrodinger equation for a two electron system with a symmetric potential $V(r_1,r_2)= V(r_2 ,r_1)$ can be chosen to be either symmetric or anti-symmetric. Also, show that it quite analogous to the first proof of Bloch's theorem.		5
Q2	(a) For l= 2,1,0,-1,-2 the spin arrangement of the two atoms are ↓,↓,↓,↓,↓ and ↓↑,↓↑,↓↑,↓↑,↓↑ respectively. Calculate the ground state of specific ions. (b) Systematically show the precession of L, S and J vector around magnetic field B.		3+2
Q3	Define electronic, ionic, and dipolar polarizability. Derive tha Clausius-Mossotti equation. Also explain in which special case we can consider negative refractive intex of materials.		5
Q4	An atom can be modeled as a simple harmonic oscillator with natural frequency ω_0. An A.C field ($E_0 e^{i\omega t}$) is applied on atom with damping constant γ. Derive the expression for complex electronic polarizability and frequency dependent dielectric constant.		5
Q5	(a) Two parallel plates having equal and opposite charges are separated by a 2 cm thick slab that has dielectric constant 3. If the electric field inside is 10^6 V/m. Calculate the polarization and displacement vector. (given $\varepsilon_0=8.85 \times 10^{-12}$ $C^2N^{-1}m^{-2}$). (b) Show that dipolar relaxation is analogous to the charging and discharging of the capacitor.		3+2