JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -1 EXAMINATION- 2024

MSc, Semester-3 (PMS)

COURSE CODE (CREDITS): 18MS1PH313(3)   MAX. MARKS: 15

COURSE NAME: CONDENSED MATTER PHYSICS- II

COURSE INSTRUCTORS: SKT   MAX. TIME: 1.0 Hour

Note: (a) All questions are compulsory.

(b) Marks are indicated against each question in square brackets.

(c) The candidate is allowed to make suitable numeric assumptions wherever required for solving problems

Q1. What is super exchange coupling? Write the complete Hamiltonian of a magnetic system having two electrons and two nucleus. Calculate the ground state of magnetic ions having $3d^5$ and $4f^7$ configuration. [3]

Q2. What are intra exchange interactions of electrons moving in two different orbital u and v. How the exchange interaction appears? By considering two electron system show that ground state is four fold degenerate. [3]

Q3. A magnetic material is placed in uniform magnetic field, write down the modified Hamiltonian. Assume that momentum of electron get modified by vector magnetic potential as $p \rightarrow p + \dfrac{e}{c}\vec{A}$. Explain Paramagnetism and Diamagnetism by calculating change in the system energy using second order perturbation theory. [3]

Q4. Give the qualitative solution of p orbitals and d orbitals using Schrödinger equation. How d orbitals splits in presence of crystal field. [3]

Q.5 Write the short note on contribution of l s coupling and j j on magnetic properties of materials. Graphically show the precession of total angular momentum J in la and jj coupling. [3]