Seat No. : _____

DL-107

December-2013

M.Sc., Sem.-I

CHE-401 : Chemistry

(Inorganic Chemistry)

Time : 3 Hours] **[Max. Marks : 70**

1. Answer the following questions : **14**
   (a) Explain the step up and step down operators of angular momentum. Prove that $L_+ L_- = L^2 - Lz^2 + \hbar Lz$.
   (b) For first order perturbation, find out the values for correction to the energy and wave function.

OR

   (a) For Hydrogen atom, by applying variation principle, prove that $E = -\frac{1}{2}$ au.
   (b) Prove that $[L^2, Lx] = 0$.

2. Answer the following questions : **14**
   (a) Explain the Great Orthogonality Theorem.
   (b) Taking wave function as the basis for irreducible representation for C_3V point group, considering 2px and 2py orbitals as the nitrogen atom in ammonia as the basis. Calculate the values for $\chi(E)$, $\chi(C_3)$ and $\chi(\sigma v)$.
   (c) Explain, by taking suitable example, stochastic matrix and Hermitian matrix.

OR

   (a) Explain the five important rules about irreducible representation and their characters by taking a suitable example.
   (b) Explain, by taking suitable example, scalar matrix and orthogonal matrix.
   (c) Find out the direct product for
      (i) $T_2 \times T_1$ and
      (ii) $E \times T_1$ in Td.

3. Answer the following questions : **14**
   (a) Derive the basic equation for diamagnetic susceptibility.
   (b) Explain the use of Pascal's constants with example.
   (c) Explain Neel temperature.

OR

(a) Write differences between Ferromagnetism and Anti-Ferromagnetism.

(b) Discuss Curie and Curie Weiss Law.

(c) Derive an equation for spin magnetic Moment.

4. Answer the following questions : **14**

(a) Explain the use of essential trace elements in biological systems.

(b) Discuss the specific functions of Na and K in human life.

(c) Discuss the use of coordination compounds in medicine.

OR

(a) Explain Nitrogen Fixation.

(b) Explain the role of chelation therapy and chelating agents.

(c) Write a note on toxic metals and their toxicity.

5. Answer the following questions in short : **14**

(a) Define : Character.

(b) Describe the implied symmetry of the irreducible representation Ag in point group C_2H on the basis of Mulliken symbol.

(c) Explain the meaning of the term $2z^2 - x^2 - y^2$.

(d) The energy integral $\int \Psi i \; H \; \Psi j \; dT$ is zero. What are the circumstances which lead to the above requirements for the molecular point group ?

(e) Define : Linear Operator.

(f) What is the kinetic energy of operator $\hat{K}$?

(g) Calculate if $5x^3$ is the eigen function of d^2/dx^2 operator or not.

(h) Give equation for 'Molar magnetic susceptibility'.

(i) Define : Magnetic Induction.

(j) Give example of intermolecular Antiferromagnetism.

(k) Which metal ions are used in MRI ?

(l) Define : Metalloporphyrins.

(m) Which compounds are used in rheumatoid arthritis ?

(n) Give full name of vitamin B_{12}.