DO-003-1104009 Seat No. _____

M. Sc. (Sem. IV) Examination

March / April - 2022

Inorganic Chemistry : C(I)-403

(Bonding in Complexes)

Faculty Code : 003

Subject Code : 1104009

Time : $2\frac{1}{2}$ Hours] [Total Marks : **70**

Instructions : (1) Answer all questions.
(2) All questions carry equal marks.

1 Answer the following : (any **seven**) **14**

(a) Discuss the magnetic moments of Ni^{+2} complexes.
(b) Explain J-J coupling.
(c) What is spin orbit coupling ?
(d) Determine $S, M_L, L.M_L$. and J in d^3 configuration.
(e) Discuss the effect of spin orbit coupling on E terms.
(f) Give the use of Tanabe-Sugano diagram.
(g) Explain the splitting of d-orbital in Octahedral geometry.
(h) Name all the Racah Parameters with symbols and use.
(i) Give the equation to find out the normalized solution for $\Theta_{(\theta)}$ equation.
(j) What is hole formalism ?

2 Answer the following : (any **two**) **14**

(a) Find out the ground state terms for d^2, d^9 configurations and calculate total multiplicity for each.
(b) What are Stepup and Stepdown operators? Derive $L < 3, -2 >$, from $L < 3, -1 >$.
(c) Construct the correlation diagram for d^2 in Oh weak field and strong Field.

3 Answer the following : (any **two**) **14**

(a) Write note on Jahn-Teller effect.

(b) Show the effect of V_{oct} on θ part

$<m/x^4+y^4+z^4/m> = 5/7\ r^4$ when $m = m' \pm 0$.

(c) Explain the Tanabe-Sugano diagram for d^4 and d^5 configurations.

(d) Show that $P_I \cos\theta = 1/2\left(5\cos^3\theta - 3\cos\theta\right)$, where $I = 3$.

4 Answer the following : **14**

(a) Show that $\left\langle m/x^4+y^4/m' \right\rangle = 1/8\ r^4 \sin^4\theta$ zero, where $m = m' \pm 4$.

(b) Calculate energy of the integral $\left\langle \phi_2\phi_1 \left| V_{oct} \right| \phi_2\phi_1 \right\rangle$, where $\left\langle \phi_1 \left| V_{oct} \right| \phi_1 \right\rangle = -4Dq$ and $\left\langle \phi_2 \left| V_{oct} \right| \phi_2 \right\rangle = Dq$.

5 Answer the following : **14**

Derive the formula $V_{oct} = 6\ Ze^2/a + \left(X^4+Y^4+z^4 - 3/5r^4\right)$ in Oh field.

OR

5 Answer the following : **14**

(a) Show that the value of $P_l^{|m|}(\cos\theta) = 1$ where $I = 0$, $m = 0$.

(b) Show that $P_l \cos\theta = 1/2\left(5\cos^2\theta - 1\right)$, where $I = 2$.