HB-003-1104009
M. Sc. (Sem. IV) Examination
April - 2023
Inorganic Chemistry : C(I)-403
(Bonding in Complexes)

Faculty Code : 003
Subject Code : 1104009

Time : $2\frac{1}{2}$ / Total Marks : **70**

Instructions :
    (1)   All questions are compulsory.
    (2)   All questions carry equal marks.

1   Answer the following : (any seven out of ten)   **14**
    (1)   Give the difference between Tanabe-Sugano and Orgel diagram.
    (2)   How Racah Parameters can be evaluated ?
    (3)   Give two possible hybridizations of ML_4 type complexes with suitable examples.
    (4)   Show Crystal Field Splitting diagram for square planar complexes.
    (5)   Define L-S coupling.
    (6)   Calculate the Magnetic Moment for Mn^{+2} and Fe^{+3}.
    (7)   What is spin multiplicity ?
    (8)   Find out the spectral term for the Fe^{++} and Fe^{+++} ions.
    (9)   What is hold formalism ?
    (10) Give the use of Tanabe-Sugano diagram.

2   Answer the following : (any two out of three)   **14**
    (1)   Show that $P1Cos = \theta = 1/2 (5Cos^3\theta - 3Cos\theta)$, where I = 3
    (2)   Explain d-orbital splitting in Tetrahedral field.
    (3)   Explain charge transfer spectra.

3   Answer the following :   **14**

     (1)   Calculate energy the integral $< \phi 2 \phi 1 \,|\, V_{oct} \,|\, \phi 2 \phi 1 >$,

          where $< \phi 1 \,|\, V_{oct} \,|\, \phi 1 > = -4Dq$ and $< \phi 2 \,|\, V_{oct} \,|\, \phi 2 = Dq$

     (2)   Explain Orgel diagram for d^2 and d^8.

<div align="center">OR</div>

3   Answer the following :   **14**

     (1)   Explain Jahn-Teller effect in Octahedral field.

     (2)   Construct the correlation diagram for d^2 in octahedral weak field and strong field.

4   Answer the following :   **14**

     (1)   Derive $(m/4 + y4/m') = 1/8 \; r4 \sin 4\theta$, where $m = m' \pm 4$

     (2)   Discuss the spectrum of $[Cr(H_2O)_6]^{+3}$ in detail. Show that how β, B and 10Dq can be determined from the spectra.

5   Answer the following : (any two out of four)   **14**

     (1)   Show that $P_1 \cos\theta = 1/2 \, (3\cos^2\theta - 1)$, where $1 = 2$

     (2)   Calculate total multiplicity with ground state spectral terms for d^1 and d^2 configurations.

     (3)   What are step up and Step down operators ?
          Derive $L < 3\; {-2} >$ from $L < 3,\; {-1}>$.

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

<div align="center">_____</div>