Rajiv Gandhi Institute of Petroleum Technology

Mid-Semester Examination

Course & Code	**Inorganic & Physical Chemistry (CY111)**
Full Marks	**40**
Date	**27/Dec/2022**
Time	**02 Hours**

- **MUST write your answers in the answer-sheet SEQUENTIALLY as provided in the question paper.**
- All the questions (**Total FOUR**) are compulsory.
- **Use a separate Answer sheet for answering questions**

Q-1.

(i) Write down the wave functions for sp hybrid orbitals as a Linear Combination of s and p orbital wave functions.

(ii) State dissimilarities between Valence Bond Theory and Molecular Orbital Theory.

(iii) Predict the electron-pair (hybridization) and molecular geometries of SF_4, and IF_5. Draw the structures and provide rationale using VSEPR Theory.

(iv) Draw the Molecular Orbital Diagrams of O_2 and H_2O.

1+2+3+4

Q-2.

(i) Draw the Structure of Calcium ion complexed with EDTA (Ethylene Diamine tetraacetate).

(ii) Draw the crystal field splitting diagram for $[CoCl_4]^{2-}$ and calculate CFSE.

(iii) Absorption spectrum of $[Ti(H_2O)_6]^{3+}$ shows one broad peak and unsymmetrical. Explain the origin of peak and its unsymmetrical nature.

(iv) Draw the Crystal-Field Splitting Energy (CFSE) level diagrams from Octahedral field to Square Planar field through Tetragonal Distortion.

1+2+3+4

Q-3.

(i) Why does Ni (II) ion form tetrahedral complex with Chloride ion?

(ii) How will you differentiate Ionic bonds from Covalent bonds?

(iii) State the reasons for low value of molar extinction coefficient (ε) for high spin octahedral complexes of Mn^{2+}.

(iv) What is Magnetic Susceptibility? Account the reasons for higher value of magnetic moment of $[Co(H_2O)_6]^{2+}$ complex than the calculated spin-only magnetic moment.

1+2+3+4

Q-4.

(i) Are $V(CO)_6$ and $Ni(CO)_4$ stable complexes? State the hybridizations as well.

(ii) Describe Oxidative Addition and Reductive Elimination.

(iii) Arrange the complexes given below in increasing order of M-C and C-O bond strength (M- transition metal). Give a suitable reason for the same.

(a) $Ni(CO)_4$, (b) $[Co(CO)_4]^-$ and $[Fe(CO)_4]^{2-}$

(iv) Write down the complete catalytic cycle of Alkene Hydrogenation using Wilkinson's catalysts.

1+2+3+4

----------**THANK YOU**----------