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M.Sc. Chemistry, Semester-I
End-Semester Examinations-December, 2024

Paper Name: Inorganic Chemistry-I **Paper Code: MCHCC-103**
Time: 2:30 hours **Maximum Marks: 60**

Note: This paper has *three* sections A, B and C. Attempt all the sections.

Section A: Answer *all* questions; **Section B:** Answer *any two* out of four questions; **Section C:** Answer *all* questions and each question has internal choice.

Abbreviations used.

CLO-Course Learning Outcome, PLO-Program Learning Outcome, BTL-Bloom Taxonomy Level, BTL1-Remember, BTL2-Understand, BTL3-Apply, BTL4-Analyse, BTL5-Evaluate, BTL6-Create.

Section A				
Attempt all questions		**15x1 = 15 marks**		
Q.No.	**Question**	**BTL**	**PLO**	**CLO**
A1	Calculate the spin-only magnetic moment of $[Mn(H_2O)_6]^{2+}$.	1-2	2	2
A2	Draw and explain the molecular geometry of SF_4.	1-2	2	2
A3	Calculate the number of valence electrons in $C_2B_4H_6$ and predict its shape.	2-3	1	2
A4	Describe the factors that affect the boiling and melting points of ionic compounds.	2-3	1	2
A5	Calculate the magnetic moment of $[CoF_6]^{3-}$ and state whether it is high-spin or low-spin	2-3	2	2
A6	Compare the acidic strengths of $HOClO_3$, $HOClO_2$, HOClO and HOCl with proper reasoning.	1-2	1	2
A7	Complete the reaction: $[Cr(H_2O)_6]^{3+} + 6NH_3 \rightarrow ?$	2-3	2	3
A8	Among Nd^{3+}, Sm^{3+}, and Eu^{3+}, which one has the highest reducing power? Justify.	2-4	2	3
A9	Describe the role of electronegativity in determining acid-base strength in non-aqueous solvents.	2-4	2	3
A10	Calculate the number of microstates for a p^3 electronic configuration.	1-3	3	3
A11	Write the electronic configuration of Tm^{3+} ion.	2	2	2
A12	Determine the oxidation state and spin state of Cr in $[Cr(H_2O)_6]^{2+}$.	1-3	2	3
A13	Write the term symbols for a d^6 electronic configuration.	2	1	2
A14	Define chelation and give two examples of chelating ligands used in coordination complexes.	3-4	3	3
A15	Write the outer electronic configuration of Dy^{3+}.	2	2	2

Section B

Attempt any two out of four questions **2x10 = 20 marks**

Q.No.	Question	BTL	PLO	CLO
B1	(a) Explain the principles of the HSAB concept. Provide examples of its application in predicting the stability of complexes. (b) Describe the concept of Wade's rules and predict the structure of $[B_9H_9]^{2-}$. Illustrate your answer with proper reasoning.	2-3	2	3
B2	Derive the term symbols for a d^2 configuration and explain the splitting pattern in a tetragonal crystal field.	2-3	2	2
B3	Compare and contrast the properties and applications of protic and aprotic solvents. Include suitable examples.	3-4	3	3
B4	Draw the molecular orbital diagram for CO and explain the bond order and magnetic nature.	4-5	2	3

Section C

Attempt all questions and each question has internal choice **5x5 = 25 marks**

Q.No.	Question	BTL	PLO	CLO
C1	Describe the Bent rule with the help of suitable examples. **OR** Compare the crystal field stabilization energy (CFSE) of $[Co(NH_3)_6]^{3+}$ and $[CoF_6]^{3-}$.	2-3	2	3
C2	Draw the molecular orbital diagram of O_2 and predict its bond order and magnetic properties. **OR** Calculate the crystal field stabilization energy (CFSE) for $[Fe(CN)_6]^{3-}$ and comment on its stability.	5-6	3	3
C3	Draw the molecular orbital diagram for $[MnO_4]^-$ and predict its bond order and magnetic properties. **OR** Describe the cis and trans isomerism in square planar complexes with examples.	2-4	3	3
C4	Explain the role of haemoglobin in oxygen transport and its interaction with CO. **OR** Describe the biological importance of chlorophyll in photosynthesis.	2-3	2	3
C5	Discuss the catalytic mechanism of nitrogenase in nitrogen fixation. **OR** Explain the hybridization and geometry of $[Ni(CO)_4]$ on the basis of valence bond theory.	2-3	2	3