**Registration No:** | | | | | | | | | | |

**Total Number of Pages: 01** **M.Sc.**

**MCYC101**

**1st Semester Back Examination 2017-18**
**INORGANIC CHEMISTRY**
**BRANCH(S): M.Sc. (AC)**
**Time: 3 Hours**
**Max Marks: 70**
**Q.CODE : B749**
**Answer Question No.1 which is compulsory and any five from the rest.**
**The figures in the right hand margin indicate marks.**

**Q1** **Answer the following questions:** **(2 x 10)**

**(a)** Which p orbital can form dπ –pπ bond with $d_{yz}$ orbital in a diatomic molecule? Diagrammatically illustrate the overlap of the bond.

**(b)** Provide two evidences in favour of dissociative mechanism of Acid Hydrolysis of $[Co(NH_3)_5Cl]^{2+}$.

**(c)** Differentiate between labile and inert complexes with examples.

**(d)** Write down the ground CF states of High Spin and Low Spin complexes of $d^5$ $O_h$ system.

**(e)** Write down the LGOs (SALCs) of ligand orbital which will match with the symmetries of $d_x2\text{-}y2$ and $d_{xy}$ orbitals of metal in an $O_h$ complex.

**(f)** Determine the structures of $ClF_5$ and $XeF_4$ from VSEPR theory.

**(g)** How does the Racah parameter 'B' vary with the oxidation state of the metal ions?

**(h)** For $[Co(NH_3)_6]^{3+}$ (Oh), one of the spin allowed transition $^1A_{1g}\rightarrow{}^1T_{1g}$ is symmetry forbidden. The M-N odd vibrational modes for Oh are $T_{1u}$ and $T_{2u}$. Is this transition vibronically allowed? Justify.

**(i)** How do the following states of a free ion split in an octahedral field?S, F, P and G

**(j)** Arrange the ligands in increasing order of trans effect: $NH_3$, $Cl^-$, CO and $OH^-$

**Q2** Calculate the s and p character of bonding and anti-bonding MOs of $H_2O$ molecule. **(10)**

**Q3** List the angular scaling factors for d-orbitals for Oh and Td complexes. **(10)**

**Q4** **(a)** Why might d-d absorption bands for tetrahedral complexes be expected to be more intense than those for octahedral complexes for the same metal ion? **(2)**

**(b)** $[Cr(H_2O)_6]^{3+}$ is expected to give three bands. Assign each band by the help of Orgel diagram. **(3)**

**(c)** Construct and explain the Orgel diagrams for a $d^2$- configuration under octahedral and tetrahedral environment. **(5)**

**Q5** Derive the possible terms of $d^2$- configuration. **(10)**

**Q6** Construct the σ and π LGOs to match the symmetry of p, $d_{x2-y2}$ and $d_{xy}$ AOs of metal in an Oh complexes. Draw the sketches of these LGOs. **(6+4)**

**Q7** **(a)** Discuss the mechanism of outer sphere electron transfer reactions. **(5)**

**(b)** What do you meant by Marcus cross reaction? Discuss its application. **(5)**

**Q8** **Write notes on :**

**(a)** Swain –Scott equation. **(5)**

**(b)** Bents rule and its application. **(5)**