# RAMAKRISHNA MISSION VIDYAMANDIRA

**(Residential Autonomous College under University of Calcutta)**

**THIRD YEAR**

**B.A./B.SC. FIFTH SEMESTER (July – December), 2012**

**Mid-Semester Examination, September 2012**

Date : 13/09/2012 **CHEMISTRY (Honours)**

Time : 2 pm – 3 pm Paper : VI Full Marks : 25

(*Answer **any one** question from each unit*)

## Unit - I

1. a) $[NiCl_4]^{2-}$ is paramagnetic while $[Ni(CN)_4]^{2-}$ is diamagnetic. Explain the observation from crystal field theory. [2]
   b) $Zn^{2+}$ and $Cr^{3+}$ form large number of normal spinels. Explain. [2]
   c) Chromium (II) fluoride and manganese (II) fluoride both have a central atom surrounded by six fluoride ligands. The Mn–F bond lengths are equidistant but Cr – F bonds are not. Explain. [2]

2. a) Aqueous solution of $Co(NO_3)_2$ is pale pink but on addition of ethanol it turns intense blue. Explain. [3]
   b) The energy difference between $dx^2 – y^2$ and dxy orbitals in a square planar field is identical to the difference between the same orbitals in the octahedral field. Explain. [2]
   c) Write down the CFSE expression for $d^6$ ion in an octahedral strong field. [1]

## Unit –II

3. a) How can you prepare extrapure chromium from one of its important occurrence. [3]
   b) What happens when ammonium molybdate is treated wih zinc in HCl followed by addition of aqueous $NH_4SCN$. [2]
   c) What is Ferrochrome. [1]

4. a) Write notes on dibenzene chromium. [2]
   b) How $K_2Cr_2O_7$ is prepared from Chromite ore. [2]
   c) Mention the differences of 3d, 4d and 5d transition metals. [2]

## Unit –III

5. a) What do you mean by Photosystem I and Photosystem II. [3]
   b) Write notes on (**any two**) : [4]
      i) Toxic metals and their toxicity
      ii) Essential elements and beneficial elements
      iii) Trace elements and ultratrace elements

6. a) Write notes on the basic chemical reactions in Biological system. [4]
   b) Name one zinc containing enzyme and state its biofunction. [3]

## Unit –IV

7. a) $\pi$-bonding is more important than $\sigma$-bonding in the formation of carbonyls. Explain with example. [2]
   b) Comment on the nucleophilic attack on a $\mu_1$ and $\mu_2$ or $\mu_3$ carbonyl. Write down the course of a nucleophilic attack on a terminal carbonyl with an example. [2]
   c) Why is Sc, Ti and Cu does not form any carbonyls? Explain. [2]

8. a) The stretching frequencies of carbonyl ($\gamma_{CO} cm^{-1}$) of the following complexes $Mo(CO)_6$, $Mo(CO)_3(NH_3)_3$ and $Mo(CO)_3(PPh_3)_3$ are 2009, 1855 and 1950. Explain. [2]
   [Stretching frequency of free CO is 2143 $cm^{-1}$]

b) Metal-metal bonding in polynuclear carbonyls is more favoured for 5d elements than 3d elements. Explain [2]

c) Explain the carbonyls stretching frequencies ($\gamma_{CO} cm^{-1}$) of the following compounds. [2]

$Cr(CO)_6$ – 2000 $cm^{-1}$
$Mo(CO)_6$ – 1984 $cm^{-1}$
$W(CO)_6$ – 1960 $cm^{-1}$