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KIBABII UNIVERSITY

**UNIVERSITY EXAMINATIONS
2017/2018 ACADEMIC YEAR**

**FOURTH YEAR SECOND SEMESTER
SUPPLEMENTARY EXAMINATIONS**

FOR THE DEGREE OF B.SC (SCIENCE)

COURSE CODE: SCH 410E

COURSE TITLE: COORDINATION AND ORGANO METALLIC CHEMISTRY

DURATION: 2 HOURS

DATE: 01/10/2018

TIME: 11:30-1:30PM

INSTRUCTIONS TO CANDIDATES

- Answer **QUESTION ONE** (Compulsory) and any other two (2) Questions.
- Indicate **answered questions** on the front cover.
- Start every question on a new page and make sure question's number is written on each page.

This paper consists of 5 printed pages. Please Turn Over



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Question One (30 Marks)

- a) Define the following terms as used in coordination compounds
- Ligand
 - Ligand donor atom
 - Chelate
 - Spectrochemical series [04]
- b) Name the following complex cations, neutral complexes, and complex anions. [04]
- $[\text{Cr}(\text{H}_2\text{O})_5\text{Cl}]^2$
 - $[\text{Fe}(\text{EDTA})]^-$
 - $[\text{Pt}(\text{en})_2(\text{SCN})_2]^{2+}$
 - $[\text{Co}(\text{CO}_3)_3]^{3-}$
- c) Name the following coordination compounds. [04]
- $[\text{Co}(\text{NH}_3)_5(\text{ONO})]\text{SO}_4$
 - $[\text{Co}(\text{NH}_3)_4\text{Br}_2]\text{Br}$
 - $[\text{Ag}(\text{NH}_3)_2][\text{Ag}(\text{CN})_2]$
 - $\text{K}_3[\text{Fe}(\text{C}_2\text{O}_4)_3]$
- e) By giving appropriate examples, differentiate between monodentate ligands and bidentate ligands. [02]
- f) State and explain three factors that affect the magnitude of Δ_o during d-splitting in complexes. [03]
- g) Give the ligand name for each of the following ligands. Identify the donor atom(s) in each.

Ligand	H_2O	$\text{C}_2\text{O}_4^{2-}$	CN^-	NH_3	NO_2^-	ONO^-
Name						

[03]

Question two (20 Marks)

- a) For the complex $[\text{Co}(\text{CN})_6]^{3-}$:
- Is Δ_o relatively large or small? [02]
 - How do the values of the splitting and the e- pairing energies compare? Circle one: Δ_o ($=$, $>$ or $<$) P [02]
 - Is the complex high spin or low spin? [02]

- iv) Draw a diagram to show the fields of the valence electrons from the metal in both the isolated ion and the complex. [04]
- v) Draw the box notation of the valence level orbital notation for the complex, circle the electrons that come from the ligands. [04]
- vi) What is the hybridization of the orbitals in the central Metal ion? [03]
- vii) Based on the orbital notation in (v) is the complex paramagnetic or diamagnetic, explain. [03]

Question three (20 Marks)

- a) Using Valence- bond theory, show that the complex ion $[\text{Fe}(\text{CN})_6]^{3-}$ is octahedral and paramagnetic. [08]
- b) Calculate the paramagnetic dipole moment for the complex, given $\mu_B = \sqrt{n(n+2)}$. [04]
- c) What are the limitations of valence-bond theory? [04]
- d) Explain the meaning of the following magnetic behavior in inorganic compounds (where possible use illustrations)
- i. Ferromagnetism [04]
 - ii. Anti ferromagnetism

Question four (20 Marks)

Discuss the applications of chelating compounds in industry and medicine. [20]