UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2021

Course: Advanced Inorganic Chemistry **Semester:** I
Program: M. Sc. Chemistry **Time:** 03 hrs.
Course Code: CHEM 7017 **Max. Marks:** 100

Instructions:
There shall be three Sections (Section A, Section B and Section C) in the Question Paper & TWO pages.
Section A contains 5 Questions of 4 marks each.
Section B- This section shall have 4 Questions of 10 marks each, out of which 3 Questions shall be compulsory and 1 Questions shall have internal choice
Section C shall have 2 Questions of 20 marks each, out of which 1 Question shall be compulsory and 1 Question shall have internal choice

SECTION - A **5 x 4 = 20 Marks**

Q 1	Describe the Janh-Teller effect in octahedral complexes of Cr^{2+} and Cu^{2+}.	CO1
Q 2	Explain Orgel energy level diagram for d^4 and d^9 States.	CO2
Q 3	Assign point group for (a) NH_2Cl (b) SiF_4 (c) HCN (d) SiFClBrI based on concept of symmetry elements	CO3
Q 4	Construct group multiplication table for C_{2v} point group.	CO3
Q 5	Mention types of boranes and give one example of each.	CO4

SECTION – B **4 x 10 = 40 Marks**
Attempt any one option from Q4 (internal choice)

Q 1	Draw the molecular orbital diagram of transition metal ion in low-spin $[Cr(en)_2(NH_3)_2]Cl_2$ complex, also determine the number of unpaired electrons. (en: *ethylenediamine*)	CO1
Q 2	For Ni^{2+} octahedral complex three absorption bands are observed at 10850 cm^{-1}, 17600 cm^{-1} and 28300 cm^{-1} determine Racah parameter. Comment on the nature of M-L bond. (M: metal; L: Ligand)	CO2
Q 3	**A:** Find the point group for the following species; a) tetraamminecopper(II) ion; b) tetracarbonylnickel(0); c) ferrocene **B:** Write Character table for C_{3v} point group.	CO3

Q 4	Identify STYX code and mention steps to assign STYX code to the following molecules: (a) $B_5H_5^{2-}$ (b) B_6H_{10} ***or*** Draw the structures of B_4H_{10}, B_5H_{11} and B_6H_9 and explain bonding types.	CO4
Section – C **2 x 20 = 40 Marks** **Internal choice is given for Q2**		
Q 1	Explain construction of group multiplication table of C_{4v} point group, describe any one row symmetry operations with structures. And also build character table for C_{4v} point group.	CO3
Q 2	What are metal carbonyls, write four methods of preparations of different metal carbonyls with at least one example. Describe structure and bonding of dimanganese decacarbonyl and dicobal octacarbonyl compounds. ***Or*** Explain properties of metal carbonyls and describe the structure and bonding nature of diiron nonacarbonyl and tetraosmonium dodecacarbonyl compounds.	CO4