**Name:**

**Enrolment No:**

**UNIVERSITY OF PETROLEUM AND ENERGY STUDIES**
**End Semester Examination, December 2022**

**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**
**(5Qx4M=20Marks)**

| S. No. | | Marks | CO |
|---|---|---|---|
| Q 1 | Explain crystal field splitting diagrams for $d^3$, $d^7$ in octahedral and tetrahedral complexes. | 4 | CO1 |
| Q 2 | Predict the point groups for the following molecules:<br><br>$SO_3$, $N_2O_2$, $NO_2$, $H_2PO_2$ | 4 | CO2 |
| Q 3 | Arrange the following as per spectrochemical series of ligands in the order of increasing covalent bonding of the following σ donation.<br><br>C donors, O donors, N donors, halide donors<br><br>(where C-Carbon, O-oxygen, N-Nitrogen) | 4 | CO1 |
| Q 4 | Discuss on different types of bonds present in higher boranes. | 4 | CO4 |
| Q 5 | Explain symmetry restrictions on dipole moments. | 4 | CO3 |

**SECTION B**
**(4Qx10M= 40 Marks)**

| | | | |
|---|---|---|---|
| Q 6 | Write Group multiplication table for $C_2v$ molecule. | 10 | CO1 |
| Q 7 | Calculate the CFSE as a function of $\Delta_O$ and Dq for low spin and high spin complexes of $[Ti(H_2O)_6]^{3+}$and $[Co(NH)_3)_6]^{3+}$ | 10 | CO3 |
| Q 8 | Draw the orgel energy level diagram for $Mn^{2+}$ octahedral complex with bands 18900 $cm^{-1}$, 23100 $cm^{-1}$, 24970 $cm^{-1}$ and explain the allowed transitions. | 10 | CO1 |

| | | | |
|---|---|---|---|
| Q 9 | Find the representative matrices for $C_{3V}$. Also deduce the same for representation matrices.<br>***Or***<br>Find the representative matrices for $C_{2V}$. Also deduce the same for representation matrices. | 10 | CO2 |
| **SECTION-C<br>(2Qx20M=40 Marks)** | | | |
| Q 10 | Explain the construction of group multiplication table of $C_3v$ point group, describe any one row symmetry operations with structures of any $C_3v$ molecule as example and build character table for $C_4v$ point group. | 20 | CO3 |
| Q 11 | Explain with any three properties of metal carbonyls and describe the structure and bonding of $Co_2(CO)_8$ and triosmium nonacarbonyls.<br>***or***<br>Explain with any three methods of preparations of metal carbonyls and describe the structure and bonding of $Fe_2(CO)_9$ and dimanganese decacarbonyls. | 20 | CO4 |