Name: **Enrolment No:**	UPES UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2019

Programme Name: M.Sc. Chemistry
Semester : I
Course Name : Coordination chemistry and fundamentals of group theory **Time** : 03 Hrs
Course Code : CHEM7003 **Max. Marks :** 100
Nos. of page(s) : 02
Instructions : Read all the below mentioned instructions carefully and follow them strictly

1) Mention Roll No. at the top of the question paper
2) Do not write anything else on the question paper except your roll number
3) ATTEMPT ALL THE PARTS OF A QUESTION AT ONE PLACE ONLY
4) All questions are compulsory
5) Internal **choice** is given for **Q 8, Q 9 & Q 12**

S. No.	**SECTION - A(**Answer **ALL** questions**)** 5 x 4 = 20 Marks	**Marks**	**CO**
Q 1	Explain crystal field splitting diagrams for d^8, d^9 in octahedral and tetrahedral complexes.	**4**	**CO1**
Q 2	Predict the point groups for the following molecules: POF_4, CH_3-CCl_3, WOF_4, AB_3	**4**	**CO3**
Q 3	Arrange the following as per Nephelauxtic series of ligands in the order of increasing nephelauxtic effect. Fe^{3+}, Fe^{2+}, Ni^{2+}, Mn^{2+}. Cr^{3+}, Co^{3+}, Pt^{4+}, Ir^{3+}	**4**	**CO1**
Q 4	Calculate the possible number of microstates for p^5 and d^6 electronic configuration	**4**	**CO2**
Q 5	How does the d^1 electronic arrangement ground state term splits into various states	**4**	**CO2**
	SECTION - B (Answer **ALL** questions**)** 5 x 8 = 40 Marks Internal **choice** is given for **Q 8 & Q 9**		
Q 6	Draw a neat diagram for depicting the Cartesian coordinates in H_2O molecule.	**8**	**CO3**
Q 7	Calculate the CFSE as a function of Δ_O and Dq for low spin and high spin complexes of Fe(II) and Co(III).	**8**	**CO1**
Q 8	Find the representative matrices for C_{2V}. and deduce the same for representation matrices. ***OR*** What are the added advantages of Tanabe-Sugano diagrams for interpretation of metal complexes spectra?	**8**	**CO3 & CO2**

Q 9	Describe about Spin selection rule ***OR*** Draw the symmetry operations of the C_{3V} point group with example molecule	**8**	**CO2 & CO3**
Q 10	Explain why many complexes exhibiting charge transfer bands in the visible region are unstable in sunlight	**8**	**CO2**
SECTION - C (Answer **ALL** questions**)** 2 x 20 = 40 Marks Internal **choice** is given for **Q 12**			
Q 11	**a.** Show diagrammatically the crystal field splitting in terms of Dq values in coplexes: (i) $[Fe(H_2O)_6]^{3+}$ (ii) $[Fe(CN)_6]^{3-}$ b. Draw the combined orgel energy diagram for two electron and two hole configurations	**10 + 10**	**CO1 & CO2**
Q 12	Construct the character table for C_{4V} for the AB_4X type molecule with specific symmetry operation diagrams. Also deduce the matrix representation for σ_{xz}, σ_{yz} using co-ordinates as bases. ***OR*** Describe and explain the Jahn-Teller effect in Octahedral complex of Cu^{2+}. Also describe the bonding in $[CoF_6]^{3-}$with molecular orbital theory	**20**	**CO3 & CO1**