Seat No. : _____

MA-222

May-2025

M.Sc., Sem.-II

407 : Chemistry

(Inorganic Chemistry)

Time : 2:30 Hours] **[Max. Marks : 70**

Instructions : (1) Character tables are given at the end.
(2) Figure to the right indicates marks.
(3) Attempt **all** questions and mention proper question number in your answer sheet.

1. Answer the following questions :
   (A) State Bent rule. Explain the proof for the same given by H. Bent. **7**
   (B) Explain VSEPR theory and discuss the shape of PCl_3 and PCl_5 based on it. **7**

OR

   (A) Calculate the electron densities, bond order and free valence for Allyl radical. **7**
   (B) Explain the structure of Fluro-Methanes according to Bent rule. **7**

2. Answer the following questions :
   (A) Interpret the following bands obtained for $POCl_3$ molecule to their corresponding Vibrations. **7**

IR Active (Liq. Phase) cm^{-1}	Raman Active (Liq. Phase) cm^{-1}
1292	1290(pol)
340	357(dePol)
267	267(pol)
580	581(depol)
487	486(pol)
–	193(depol)

   (B) Determine the orbitals (SALC) for SP_2 hybridization. **7**

OR

   (A) Consider molecule AB_3 (D_3h), which hybridization will you propose for π-bonding ? **7**
   (B) Determine the irreducible representation for Γ stretching for AB_4 (D_4h). **7**
   [Given : $\Gamma 3N = A1g + A2g + B1g + B2g + Eg + 2A2u + B2u + 3Eu$]

3. Answer the following questions :

(A) Discuss in detail haemoglobin and myoglobin and their role in body. **7**

(B) Discuss characteristics and structure of Vitamin B_{12} (Cyano cobalamin). **7**

OR

(A) Discuss Application of fluorescence quenching in drug-DNA binding studies. **7**

(B) Write a short note on Na-K pump. **7**

4. Answer the following questions :

(A) Discuss the effect of; (a) Ionic size (b) Ionic charge (c) Electronegativity and class of metal on the stability constant of metal Complex with example. **7**

(B) Discuss the method involved with determination of shifts in the half wave potential to determine the stability of complexes. **7**

OR

(A) Discuss in detail Cis-DDP. **7**

(B) Discuss the Ion exchange method to determine metal Complex stability constant. **7**

5. Answer in Short (any **Seven**) out of Twelve : **14**

(i) Explain 'Exclusion Rule'.

(ii) Define 'Redundant Vibration (term)'.

(iii) Define the degree of freedom and fundamental mode of vibrations for CO_3.

(iv) Define insulators.

(v) The Delocatization Energy (DE) of Cyclobutadine is _____

(vi) According to Bent rule, the C – F distance in CF_4 is shorter than in CH_3F. True or False.

(vii) How will you define "overall stability constant" ?

(viii) What is Radio Diagnostic Agent ?

(ix) What is the full form of MRI ?

(x) What is the name of ligand system present in Vitamin B_{12} ?

(xi) Give an example of optical method for the determination of Metal complex stability constant.

(xii) Give definition of 'Oxygenases'.

SOME USEFUL CHARACTER TABLES

C_{3v}	E	$2C_3$	$3\sigma_v$		
A_1	1	1	1	z	x^2+y^2, z^2
A_2	1	1	−1	R_z	
E	2	−1	0	(x, y) (R_x, R_y)	$(x^2-y^2, 2xy)$ (xz, yz)

D_{3h}	E	$2C_3$	$3C_2$	σ_h	$2S_3$	$3\sigma_v$		
A_1'	1	1	1	1	1	1		x^2+y^2, z^2
A_2'	1	1	−1	1	1	−1	R_z	
E'	2	−1	0	2	−1	0	(x, y)	(x^2-y^2, xy)
A_1''	1	1	1	−1	−1	−1		
A_2''	1	1	−1	−1	−1	1	z	
E''	2	−1	0	−2	1	0	(R_x, R_y)	(xz, yz)

D_{4h}	E	$2C_4$	C_2	$2C'$	$2C'$	i	$2S_4$	σ_h	$2\sigma_v$	$2\sigma_d$		
A_{1g}	1	1	1	1	1	1	1	1	1	1		x^2+y^2, z^2
A_{2g}	1	1	1	−1	−1	1	1	1	−1	−1	R_z	
B_{1g}	1	−1	1	1	−1	1	−1	1	1	−1		x^2-y^2
B_{2g}	1	−1	1	−1	1	1	−1	1	−1	1		xy
E_g	2	0	−2	0	0	2	0	−2	0	0	(R_x, R_y)	(xz, yz)
A_{1u}	1	1	1	1	1	−1	−1	−1	−1	−1		
A_{2u}	1	1	1	−1	−1	−1	−1	−1	1	1	z	
B_{1u}	1	−1	1	1	−1	−1	1	−1	−1	1		
B_{2u}	1	−1	1	−1	1	−1	1	−1	1	−1		
E_u	2	0	−2	0	0	−2	0	2	0	0	(x, y)	