

M. Sc. DEGREE END SEMESTER EXAMINATION : MARCH 2023**SEMESTER 4 : CHEMISTRY****COURSE : 21P4CHET13EL : ADVANCED INORGANIC CHEMISTRY***(For Regular - 2021 Admission)*

Duration : Three Hours

Max. Weights: 30

PART A**Answer any 8 questions****Weight: 1**

1. Draw the A_{2u} molecular orbital of ferrocene. (R, CO 1)
2. What is the principle behind XRD analysis for characterizing nano particles? (U, CO 4)
3. What is the significance of Bohr exciton diameter in quantum dot chemistry? (An, CO 4)
4. Represent the autoionization of $POCl_3$. (U, CO 5)
5. Give an example of solvolysis and solvation reaction in liquid ammonia. (U, CO 5)
6. Deduce the characters of the reducible representations for the D term in an Octahedral field. What are the splitting terms of D term. (A, CO 1)
7. Explain photo chromism using inorganic complexes as example. (U, CO 3)
8. Find the ground state term for d^2 and d^3 configuration. (A)
9. Find the direct product of $t_{2g}^1 e_g^1$ configuration in octahedral symmetry? (A, CO 1)
10. Which crystalline compounds exhibit diamondid structures? (A, CO 6)
(1 x 8 = 8)

PART B**Answer any 6 questions****Weights: 2**

11. Discuss on the importance of molecular recognition in metallo supramolecular chemistry. (U, CO 6)
 12. Bioresources can be used to prepare nanomaterials. Elaborate on the statement by citing two examples and synthesis procedures. (A, CO 4)
 13. Explain the principle and mechanism of sensitizer supported metal oxide systems. (A, CO 3)
 14. Discuss the leveling effect of liquid ammonia. (A, CO 5)
 15. Explain in detail about the molecular receptors which are hosts for neutral molecules with suitable examples. (A, CO 6)
 16. Decompose the following RR into IRR combination. (A, CO 1)
- | | | | | | | | | | | |
|------------|---|--------|--------|--------|--------|---|--------|--------|-------------|-------------|
| O_h | E | $8C_3$ | $6C_2$ | $6C_4$ | $3C_2$ | i | $6S_4$ | $8S_6$ | $3\sigma_h$ | $6\sigma_d$ |
| Γ_F | 7 | 1 | -1 | -1 | -1 | 7 | -1 | 1 | -1 | -1 |
17. Write a note on water photolysis. Explain the role of catalyst and photochemical cells in water photolysis. (A, CO 3)
 18. Explain the Vibrational analysis of Water molecule and find out the normal modes of vibration. (E, CO 1)
(2 x 6 = 12)

PART C
Answer any 2 questions

Weights: 5

19. Briefly discuss the characterization of nanomaterials using UV-Visible spectroscopy and XRD. (U, CO 4)
20. Using Group theory explain MO theory of sigma bond formation in the complex $[\text{Mn}(\text{H}_2\text{O})_6]^{3+}$. Expand the discussion to Crystal Field Splitting and nature of electron spin in the complex. (U, CO 1)
21. Describe the principle of EPR spectroscopy. Define g value and what are the factors which affect its value? Calculate g value of the methyl radical which shows an EPR peak at 3300×10^{-4} T in a spectrometer operating at 9240 MHz. ($\beta = 9.27 \times 10^{-24} \text{ JT}^{-1}$) (A, CO 2)
22. Explain (a) Solvo - thermal method (b) Microwave-assisted method (c) Electrochemical method for the synthesis of MOFs (U, CO 5)
- (5 x 2 = 10)**

OBE: Questions to Course Outcome Mapping

CO	Course Outcome Description	CL	Questions	Total Wt.
CO 1	Apply the principles of group theory in co-ordination complexes.	A	1, 6, 9, 16, 18, 20	12
CO 2	Identify the structure of an inorganic solid using IR, Raman, Mossbauer and EPR spectroscopic techniques.	A	21	5
CO 3	Explain the concepts of inorganic photochemistry.	U	7, 13, 17	5
CO 4	Describe the structure and properties of nanomaterials.	R	2, 3, 12, 19	9
CO 5	Explain the chemistry of acids, bases, non-aqueous solvents and metal-organic frameworks.	R	4, 5, 14, 22	9
CO 6	Explain the chemistry of fullerenes and metallo-supramolecular structures.	R	10, 11, 15	5

Cognitive Level (CL): Cr - CREATE; E - EVALUATE; An - ANALYZE; A - APPLY; U - UNDERSTAND; R - REMEMBER;