

This question paper contains 3 printed pages]

LB—09—2023

FACULTY OF SCIENCE

M.Sc. (First Year) (First Semester) EXAMINATION

APRIL/MAY 2023

(NEW/CBCS PATTERN)

CHEMISTRY

Paper-I (CH-411)

(Inorganic Chemistry)

(Wednesday, 3-5-2023)

Time : 10.00 a.m. to 1.00 p.m.

Time— Three Hours

Maximum Marks—75

N.B. :— (i) All questions are compulsory.

(ii) Use of log table and calculator is allowed.

1. Solve any *three* of the following : 15

- (a) What are labile and inert complexes ? Explain it by using VBT approach.
- (b) Explain the S_N^2 mechanism with the hydrolysis of $[\text{Co}(\text{NH}_3)_5\text{Cl}]^{2+}$.
- (c) Give an account on scanning electron microscopy techniques for characterization of nanomaterials.
- (d) Calculate the number of microstates of P^1 and d^1 arrangement.
- (e) Explain the laporte selection rule for electronic transitions in complexes.

P.T.O.

2. Solve any *three* of the following : 15

- (a) Explain electron-transfer reaction with suitable example and sketch the profile of the energy versus reaction coordinate for an electron transfer reaction with identical reactant and product.
- (b) Explain Taube's reaction is the inner sphere reaction between $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$ and $[(\text{NH}_3)_5\text{CoCl}]^{2+}$.
- (c) Explain vapour-phase synthesis of nanoparticles.
- (d) Describe Tanabe-Sugano diagram for the d^2 complex.
- (e) Give an account on LMCT.

3. Solve the following :

- (a) S_N^1 CB mechanism in a ligand substitution reaction with a metal complex give second order kinetics. Justify this. 8

Or

Find out ground state term symbol for d^3 configuration.

- (b) Give the factors which favour outer sphere electron transfer reaction. 7

Or

Give the proof for inner sphere mechanism.

4. Solve the following :

- (a) The electron transfer from $[\text{Co}(\text{NH}_3)_6]^{2+}$ to $[\text{Co}(\text{NH}_3)_6]^{3+}$ is extremely slow. What is the reason ? 8

Or

Explain L-S coupling and $j-j$ coupling microstates and its calculation.

(b) Give an account on natural and artificial nanomaterials. 7

Or

Compare charge transition spectra with $d-d$ transition.

5. Write notes on (any three) : 15

- (a) Anation reaction
- (b) Nephelauxetic effect
- (c) Carbon nanotube
- (d) MLCT
- (e) Hole formulation.