B.Sc. 5th Semester (Honours) Examination, 2022 (CBCS)

Subject : Chemistry

Course : CC-XI

Time: 2 Hours **Full Marks: 40**

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

1. Answer *any five* questions: 2×5=10

(a) Define hypoligated and hyperligated complex.

(b) What is the significance of the term Dq?

(c) '$d-d$'-transitions are forbidden—Comment.

(d) Define magnetic double exchange phenomenon.

(e) What is nephelauxetic effect?

(f) Write the equation by using which we can determine the magnetic moment of the lanthanides.

(g) Write some differences between $4f$ and $5f$ orbitals.

(h) Write the cause of actinide contraction.

2. Answer *any two* questions: 5×2=10

(a) (i) Give an example of low-spin Tetrahedral-complex and draw its 'd'-orbital spliting diagram with electronic configuration and calculate its CFSE value. 3

(ii) Which type of distortion is preferred by Cu(II)-complexes? Give reason. 2

(b) (i) What is OSSE? Explain with example. 3

(ii) Define magnetic super exchange phenomenon. 2

(c) (i) Explain the electronic spectrum of $[Ti(H_2O_6]^{3+}$. 3

(ii) Define pairing energy and give the factors on which pairing energy depends. 2

(d) (i) Draw the Orgel diagram of d^2 and d^4 for Oh & Td complexes respectively. 3

(ii) Draw the structure of Ni-DMG complex and calculate its CFSE value. 2

3. Answer *any two* questions: 10×2=20

(a) (i) You have passed a solution containing La^{3+}, Gd^{3+} and Lu^{3+} through an ion-exchange column. Then you elute the column with ammonium citrate solution. Explain in which order the ions will be eluted out. Calculate the effective magnetic moment (μ_{eff}) of Pr^{3+}-ion (3+2)

(ii) The lanthanide elements show the common stable oxidation state of +3. Explain. 2

(iii) Mention the conditions for orbital contribution in spin only magnetic moment. 3

(b) (i) Determine the magnetic moment for the ground state of Ho^{3+} ion and Gd^{3+} ion. 3

(ii) Draw the MO diagram of LMCT. 2

(iii) One complex of Fe^{+2} is coloured due to $d - d$ transition, but another Fe^{+2} complex is very pale coloured. Explain with appropriate illustration. 3

(iv) Why heavier congener elements easily produce low-spin complexes? 2

(c) (i) Define ferromagnetism and anti-ferromagnetism correlating with the spin exchange coupling constant (J). 3

(ii) What do you mean by Curie Point and Neel Point? 2

(iii) Write the relationship between spectra and magnetic moment of a complex. 2

(iv) Comment on the magnetic behaviour of solid AgO. 3

(d) (i) What is intensity stealing? Give an example. 3

(ii) 'MnO_4^- is intensely colourd but TcO_4^- and ReO_4^- are colourless'— account for the fact. 2

(iii) Absorption band of $[V(H_2O)_6]^{2+}$ gives transition band at 12300 cm^{-1}, 18500 cm^{-1} and 27900 cm^{-1}. Identify the transition for 12300 cm^{-1}. 2

(iv) Aqueous Mn(II)–Sulphate is almost colourless but aqueous solution of Cu(II)–sulphate is blue — Explain. 3
