

BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI, PILANI CAMPUS
DEPARTMENT OF CHEMISTRY
II SEMESTER 2022-23
COMPREHENSIVE EXAM PART-B (OPEN BOOK)

ADVANCED INORGANIC CHEMISTRY (CHEM G552)
MAX MARKS: 50

DATE: MAY 22, 2023
TIME: 3-6PM

Instructions: There are FIVE questions in all. Attempt all the questions. Start answering each question on a fresh page and answer all parts of the question together. Pencil should not be used. Symbols have usual meanings. Do not scribble on the question paper.

Q1 (a) For an octahedral coordination complex (d^8 configuration), three bands are observed at energies of 11000 cm^{-1} , 14667 cm^{-1} and 22800 cm^{-1} . Determine the value of Δ_o for the complex in cm^{-1} . [10]

(b) How many d-d transitions will be observed for $[\text{MnL}_6]^{2+}$, where L is a very strong field ligand? Specify those transitions by using proper symbols. [5]

Q2 Consider that the substitution reaction in an octahedral complex, $[\text{ML}_6]^{n+}$ (where L is a strong field ligand) follows dissociative mechanism and forms a trigonal bipyramidal intermediate geometry. Calculate and predict the lability of Ti(II), V(II) and Mn(II) complexes. Arrange these complexes in increasing order of lability. [10]

Q3 Consider a hypothetical case where a transition metal centre forms a complex with square pyramidal geometry, $[\text{ML}_5]^{n+}$, with neutral ligands L. Deduce the LGOs of the complex. Draw properly labeled MO diagram. [10]

Q4 Determine the symmetries of **(i)** Translational; **(ii)** Rotational and **(iii)** Vibrational modes in PCl_5 . Determine the IR and Raman activity of the vibrational modes in PCl_3 . [10]

Q5 (a) Differentiate between inner sphere and outer sphere electron transfer reactions. **(b)** What are the selection rules in electronic spectroscopy? [3+2]

