BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: MSc/IMSc **SEMESTER: IV/X**
BRANCH: CHEMISTRY **SESSION: SP/2025**

SUBJECT: CH513 INORGANIC PHOTOCHEMISTRY

TIME: 3 Hours **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

			CO	BL
Q.1(a)	What is the difference between internal conversion (IC) and intersystem crossing (ISC)? Why are internal conversion (IC) and intersystem crossing (ISC) more rapid in heavier transition metal complexes?	[5]	1	1
Q.1(b)	Using an energy level diagram, discuss the possible electronic transition in $Cr(bpy)^{3+}$ system (bpy: bipyridine). *Or* Derive the rate of reaction for a unimolecular photochemical reaction.	[5]	1	2
Q.2(a)	Discuss the possible electronic transition in an octahedral complex using molecular orbital theory.	[5]	2	2
Q.2(b)	Differentiate between Adiabatic photochemical reaction (APCR) and Diabatic photochemical reaction (DPCR). Draw the energy level diagram (potential energy vs reaction coordinate) depicting the transformation of reactant to product in APCR and DPCR.	[5]	2	3
Q.3(a)	a) Excited state of $Ru(bpy)_3Cl_2$ is more oxidizing as well as more reducing than the reduced state – Explain	[4]	3	1
Q.3(b)	With a proper scheme, discuss and represent the energy level diagram for the various low-lying excited states and related photophysical processes.	[4]	3	2
Q.3(c)	Write the key reactions to show the photochemical reduction of water into hydrogen by $Ru(bpy)_3Cl_2$	[2]	3	3
Q.4(a)	Explain the structure and aromaticity of porphyrin. Classify them into natural and synthetic types with suitable examples	[5]	4	1
Q.4(b)	Describe the photophysical processes in porphyrins. How are these affected by the nature of the central metal?	[5]	4	2
Q.5(a)	Discuss the photodegradation of chlorinated VOCs. How NO_x or SO_2 can be removed?	[5]	5	3
Q.5(b)	Explain the function of dye-sensitized solar cells.	[5]	5	1

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