

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

CLASS: BTECH / IMSC
BRANCH: BT/CHEMICAL/CIVIL/ME/PIE/FT/PHYSICS

SEMESTER : II/ADD
SESSION : SP/2025

SUBJECT: CH24101/CH101 CHEMISTRY

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.

		[Marks]	CO	BL
Q.1(a)	(i) Write the equation of spin only magnetic moment. Observed magnetic moment of $[\text{Cu}(\text{OAc})_2 \cdot \text{H}_2\text{O}]_2$ is less than the spin only magnetic moment. Explain . (ii) Explain the origin of color in $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ and $\text{K}_2\text{Cr}_2\text{O}_7$ from the electronic transition theory.	[3+2]	1	2
Q.1(b)	Explain the crystal field splitting in tetrahedral complexes with the help of energy level diagram.	[5]	1	2
Q.2(a)	(i) Explain how substituted allenes can be optically active, inspite of having no chiral carbon. (ii) Write the resonance structure of 1,3-butadiene.	[3+2]	2	2
Q.2(b)	Compare and contrast the Pinacol rearrangement and the Curtius rearrangement in terms of starting material, mechanism, and products.	[5]	2	4
Q.3(a)	In a temperature-jump experiment, derive the expression for the relaxation time τ of a reversible reaction $\text{A} \rightleftharpoons \text{B}$ in terms of the forward and reverse rate constants.	[5]	3	3
Q.3(b)	Derive Michaelis -Menten equation.	[5]	3	3
Q.4(a)	With the help of a neat diagram, compare the electronic transitions possible for C-C, C=C, C=O & C=C-C=C bonds.	[5]	4	4
Q.4(b)	(i) Explain the principle of proton nuclear magnetic resonance (^1H NMR) spectroscopy. Discuss the significance of chemical shift and spin-spin coupling in interpreting an NMR spectrum (i) Explain the splitting pattern in the ^1H NMR spectrum of 1,1-dibromoethane.	[3+2]	4	2
Q.5(a)	(i) Discuss the following terms: Phase, Component, Degree of Freedom. (ii) Calculate the number of components and phases in the following system: Thermal decomposition of calcium carbonate in a closed vessel. $\text{CaCO}_3(\text{s}) \rightleftharpoons \text{CaO}(\text{s}) + \text{CO}_2(\text{g})$	[3+2]	5	2,3
Q.5(b)	(i) Construct the phase diagram of lead-silver system and describe its use in understanding: (a) Eutectic point (b) Desilverization of argentiferous lead (ii) Draw and explain the Van't Hoff plot for exothermic and endothermic reactions.	[3+2]	5	6,2