Name: **Enrolment No:**	

UPES

End Semester Examination, May 2025

Course: Electrochemical Thermodynamics **Semester: II**

Program: MSC Chemistry **Time: 03 hrs.**

Course Code: CHEM7064 **Max. Marks: 100**

Instructions: Read all the questions carefully. There is a choice in section B and C for question 9 and 11.

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	Explain thermodynamic probability by relating macrostates and microstates	**4**	**CO1**
Q 2	Depict the indistinguishable factors in ammonia molecules.	**4**	**CO2**
Q 3	Determine the mean activity of the Na_2SO_4 molecule based on its concentration and activity coefficient, using its dissociation reaction.	**4**	**CO3**
Q 4	Write the expression for the rotational partition function when the characteristic rotational temperature is lower than the applied temperature.	**4**	**CO2**
Q 5	Compare the Gibbs function and Helmholtz function by highlighting four key differences.	**4**	**CO1**
	SECTION B **(4Qx10M= 40 Marks)**		
Q 6	A company manufactures four types of chocolates: 20% dark, 35% milk, 25% sweet, and 20% with nuts. Given a batch of 100 chocolates, what is the probability that it contains exactly 50 dark, 15 milk, 25 sweet, and 10 nut chocolates.	**10**	**CO1**
Q 7	Point out the relation between enthalpy and partition function for a thermodynamic system.	**10**	**CO2**
Q 8	Emphasize Einstein's theory of specific heat capacity and discuss its limitations	**10**	**CO2**
Q 9	Find out the magnitude of $\frac{\theta_r\,(H_2)\;x\;\theta_r\,(D_2)}{\theta_r\;(HD)^2}$. θ_r is characteristic temperature of rotation and bond length being same for all the molecules. **Or** Present nuclear partition function for H_2 (ortho) and H_2 (para) molecule.	**10**	**CO2**

SECTION-C (2Qx20M=40 Marks)			
Q 10	i) Formulate the excess functions with respect to chemical potential and Gibbs free energy. ii) Determine the activity coefficients of 0.001 M NaCl and 0.001 M $MgCl_2$.	**10 + 10**	**CO3**
Q 11	i) Obtain the equation for the rate constant using transition state theory. ii) Illustrate the rate constant for unimolecular reaction based on Lindemann theory. **Or** i) Mention key features of collision theory of reaction rate ii) Discuss the factors that influence the rate constant when an inert electrolyte is added to an ion-interacting reaction, using Debye-Hückel theory as a reference.	**10 + 10**	**CO3**