UPES
End Semester Examination, May 2024

Course: Electrochemical Thermodynamics	**Semester: II**
Program: MSc (Chemistry)	**Time: 03 hrs.**
Course Code: CHEM7053	**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	Define ground state degeneracy in case of nuclear partition function.	4M	CO2
Q 2	Find out Rotational partition function for H_2O, NH_3, C_6H_6 by applying symmetry number	4M	CO2
Q 3	A certain system of non-interacting particle has the single partition function i.e. $$f = \frac{AT^m}{V}$$ where A is a constant. Derive the expression for average energy per particle.	4M	CO3
Q 4	Illustrate relation between state functions U, H, T, V, S, P according to Maxwell equation.	4M	CO1
Q 5	Demonstrate excess function of mixing in terms of chemical potential.	4M	CO3

SECTION B
(4Qx10M= 40 Marks)

Q 6	Define activity co-efficient and demonstrate its range from negative to positive in terms of concentration.	10M	CO3
Q 7	How much heat will be rejected to the room per second if 17 J electrical energy is given to the refrigerator. Given, temperature of refrigerator is -4 °C and room temperature is 25 °C.	10M	CO1
Q 8	Which one is having higher mean activity co-efficient and why i) 0.001 M NaCl ii) 0.001 M $MgCl_2$	10M	CO3
Q 9	Draw the Einstein model for specific heat capacity of solids. **Or** Describe vibrational partition function for energy level with zero-point energy.	10M	CO2

	SECTION-C **(2Qx20M=40 Marks)**		

Q 10	Derive the statistical distribution for the following condition:
	   i) Particles are non-distinguishable.
	   ii) More than one particle resides in one energy level.
		20M	**CO1**

Q 11	Define partition function and illustrate its components based on the different types of motions in the molecules. **Or** Derive the relation between thermal wavelength and translational partition function using the concept of particle moving in a three-dimensional box.	**20M**	**CO2**