Register No : _____

THE KAVERY ENGINEERING COLLEGE

(An Autonomous Institution)

B.E/B.TECH DEGREE END SEMESTER THEORY EXAMINATIONS, NOV/DEC 2025

Fifth Semester

Chemical Engineering

CH3501 – Chemical Engineering Thermodynamics - II

(Steam Tables/ Compressibility Charts can be Permitted)

(Make suitable assumptions if necessary)

Regulations - 2021

Duration : 3 Hrs *Maximum : 100 Marks*

*PART – A (ANSWER ALL QUESTIONS) (Marks 10*2=20)*

Q.No	*Questions*	*BTL*	*CO*	*Marks*
1.	List the classification of non ideal solutions.	L1	1	2
2.	What are partial properties? State and explain any one property.	L1	1	2
3.	State Henry's law.	L1	2	2
4.	Define the term tie line in boiling point diagram.	L1	2	2
5.	Write down Wilson equation and give its significance.	L1	3	2
6.	What is the effect of pressure on azeotropic composition?	L1	3	2
7.	What are the factors affecting equilibrium conversion?	L1	4	2
8.	Explain the effect of presence of excess reactants on chemical reaction equilibrium constant.	L2	4	2
9.	Define ton of refrigeration.	L1	5	2
10.	Recall some properties of an ideal refrigerant.	L1	5	2

*PART – B (ANSWER ALL QUESTIONS) (Marks 5*16 = 80)*

Q.No			*Questions*	*BLT*	*CO*	*Marks*
11.	a	i	What does Gibbs-Duhem equation relate? Derive various forms of Gibbs-Duhem equation.	L2	1	10
		ii	Prove that the partial molar mass of a species in solution is equal to its molar mass (molecular weight).	L2	1	6
			Or			
	b		Develop the relationship between activity coefficient and excess chemical potential.	L3	1	16
12.	a		Discuss the effect of temperature and pressure on the composition of an azeotrope.	L2	2	16
			Or			
	b	i	State, derive and prove the conditions for phase equilibrium in multicomponent systems.	L2	2	10
		ii	Show that at pressure approaching zero, the fugacity is equal to pressure.	L2	2	6

13.	a		The ethanol-water system forms an azeotrope at 78.15°C and the corresponding ethanol composition is 89.43 mole %. The vapour pressure of water at 78.15°C is 329 mm Hg and that of ethanol is 755 mm Hg at the same temperature. Construct the equilibrium curve for the ethanol-water system at a total pressure of 760 mm Hg.	L3	3	16
			Or			
	b		Develop and explain the thermodynamic consistency tests for the activity coefficient data for a binary mixture.	L3	3	16
14.	a	i	Discuss the relation between equilibrium constant and standard Gibbs free energy change.	L2	4	8
		ii	Explain the effect of temperature on equilibrium constant for a mixture.	L2	4	8
			Or			
	b	i	Derive an expression for the effect of temperature on the equilibrium constant for a mixture.	L3	4	8
		ii	Identify the equilibrium constant for the reaction: C_2H_4 (g) + H_2O (g) → C_2H_5OH (g) at 600 K. The data given are as follows: ΔG^o_{298} = -8494 J/g.mole $\Delta H^o_{f\,298}$ for C_2H_5OH(g) = -235308 J/g.mole $\Delta H^o_{f\,298}$ for C_2H_4 (g) = 52283 J/g.mole $\Delta H^o_{f\,298}$ for H_2O (g) = - 241826 J/g.mole	L3	4	8
15.	a	i	List the various methods for liquefaction of gases. Sketch the processes in a T-S diagram and explain the Linde's liquefaction process.	L2	5	10
		ii	A refrigeration system requires a 1 kW of power for a heat supply rate of Refrigerator is 3 kJ/s i. What is the Coefficient of Performance? ii. How much heat is rejected from the system? iii. If heat rejection is at 35°C, what is the lowest temperature the system can possibly maintain?	L3	5	6
			Or			
	b		Explain with a schematic diagram the working of an absorption refrigeration process.	L2	5	16