Q. Code:971630

Reg. No. | | | | | | | | | | | | | |

B.E./ B.TECH. DEGREE EXAMINATIONS, MAY 2024

Fourth Semester

CH22408 – CHEMICAL ENGINEERING THERMODYNAMICS-II

(Information Technology)

(Regulation 2022)

TIME:1 HOUR 30 MINUTES **MAX. MARKS: 50**

COURSE OUTCOMES	STATEMENT	RBT LEVEL
CO 1	Identify the partial Molar property of solutions upon mixing.	**3**
CO 2	Envisage the equilibrium between phases in multicomponent systems and Excess property of solutions.	**4**
CO 3	Explore and generate the phase diagram data to find the effect of temperature and pressure on azeotropic conditions.	**4**
CO 4	Apply knowledge on various models used to evaluate the equilibrium data to test the thermodynamic consistency.	**4**
CO 5	Identify and calculate the equilibrium constant for various systems	**4**

PART- A(10x2=20Marks)

(Answer all Questions)

		CO	RBT LEVEL
1.	Interpret Partial Molar properties with an example.	**1**	**2**
2.	Mention the effect of temperature on chemical potential.	**1**	**2**
3.	Cite how Gibb's free energy function is referred to as generating function.	**2**	**2**
4.	Mention the entropy change of Mixing for ideal Solutions.	**2**	**2**
5.	Interpret the applicability of Raoults law.	**2**	**2**
6.	List the applications of ternary liquid equilibrium?	**2**	**2**
7.	Outline the criterion applicable for low pressure VLE problems?	**4**	**3**
8.	Construct the local composition models for activity coefficients.	**4**	**3**

9.	Infer the effects of temperature on equilibrium constant?	**5**	**3**
10.	Identify the effect of Pressure on Equilibrium composition	**5**	**3**

PART- B (2x 10=20Marks)

		Marks	CO	RBT LEVEL

11. (a) Assess the partial molar volumes of methanol and water in a 50 mol % water solution. Given the following data at 1 bar and 298 K. **(10)** **1** **4**

X (mole fraction of methanol)	0	0.114	0.197	0.249	0.495	0.692	0.785	0.892	1.0
V x 10^3 m^3/mol	0.0181	0.0203	0.0219	0.023	0.0283	0.0329	0.0352	0.0379	0.0407

(OR)

(b) Elucidate Gibbs- Duhem equations from partial molar properties and also its applications. **(10)** **1** **4**

12. (a) Water (1) - Hydrazine (2) system forms an azeotrope containing 58.5 mole % hydrazine at 393K and 101.3KPa. Estimate the equilibrium vapor composition for a solution containing 20 mole% hydrazine. The relative volatility of water with reference to hydrazine is 1.6 and may be assumed to remain constant in the temperature range involved. The vapor pressure of hydrazine at 393K is 124.76Kpa **(10)** **3** **4**

(OR)

(b) Assuming Raoult's law to be valid for the system Benzene (1) –Ethyl Benzene (2) and the vapor pressures are given by the Antoine equations. **(10)** **3** **4**

$$\ln P_1^s = 13.8858 - \frac{2788.51}{T - 52.41}$$

$$\ln P_2^s = 14.0045 - \frac{3279.47}{T - 60.00}$$

Where P is in KPa and T is in K. Perceive the T –x-y diagram at 373 K

PART- C (1x 10=10Marks)

(Q.No.13 is compulsory)

	Marks	CO	RBT LEVEL
13. Estimate the standard free energy change and equilibrium constant at 700 K for reaction	**(10)**	**5**	**5**

$N_2(g) + 3\ H_2(g)$ $NH_3(g)$,

given that the standard heat of formation and standard free energy of formation of ammonia at 298 K to be 46,100 J/mol and -16,500 J/mol respectively. The specific heat (J/mol K) data are given as functions of temperature (K)

N_2 :$27.27 + 4.93 \times 10^{-3} T$

H_2 :$27.01 + 3.51 \times 10^{-3} T$

NH_3 :$29.75 + 25.11 \times 10^{-3} T$

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