U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

August 2024 Semester End Main Examinations

Programme: B.E. **Semester: IV**
Branch: Chemical Engineering **Duration: 3 hrs.**
Course Code: 23CH4PCTD2 **Max Marks: 100**
Course: Process Engineering Thermodynamics-II

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

		UNIT - I	CO	PO	Marks
1	a)	Prove that, $$dH = C_P dT + \left[V - T\left(\frac{\partial V}{\partial T}\right)_P dP\right]$$ $$dU = C_P dT - \left[PdV + T\left(\frac{\partial V}{\partial T}\right)_P dP\right]$$	CO1	PO1	12
	b)	Determine the enthalpy of vaporization of water at 150°C, given that the saturation pressure is 361.3 kPa at 140°C and 617.8 kPa at 160°C, and the specific volume at 150°C is 0.3917 m^3/kg.	CO2	PO2	08
		OR			
2	a)	Derive Clausius Clapeyron equation stating all assumptions made?	CO2	PO2	10
	b)	Prove that $$dS = \frac{C_P}{T} dT - \beta V dP$$	CO1	PO1	10
		UNIT - II			
3	a)	Describe any two methods for the estimation of fugacity.	CO3	PO2	10
	b)	Calculate the fugacity of liquid pentane at 313 K and 10 bar. The saturation pressure of butadiene at 313 K is 4.2 bar. The molar volume and saturated fugacity of liquid butadiene at 313 K are 90.45×10^{-6} m^3/mol and 4.12 bar, respectively.	CO3	PO2	10
		OR			
4	a)	Explain the tangent intercept method for the estimation of partial molar property.	CO3	PO2	10
	b)	Calculate the partial molar volume of water in a 50 mole% ethanol-water solution in which the partial molar volume of ethanol is 52.37×10^{-6} m^3/mol. Data: The density of solution is 800.21 kg/m^3.	CO3	PO2	10

			UNIT - III			
	5	a)	Describe the T-x-y diagram with a neat sketch.	***CO4***	***PO3***	**10**
		b)	Show that in a binary solution, if solute obeys Henry's law, the solvent obeys Lewis Randall rule.	***CO4***	***PO3***	**10**
			UNIT - IV			
	6	a)	Describe any two methods of testing the consistency of VLE data.	***CO5***	***PO3***	**10**
		b)	An azeotrope consists of 42 mole% Acetone(component 1) and 58 mole% methanol (component 2)at 760 mm Hg and 313 K. At 313 K, the vapor pressure of acetone and methanol are 786 mm Hg and 551 mm Hg respectively. Calculate the Van Laar constants	***CO5***	***PO3***	**10**
			UNIT - V			
	7	a)	Derive Vant Hoff equation stating all assumptions.	***CO6***	***PO3***	**10**
		b)	An equimolar mixture of CO(g) and water(g) enters a reactor which is maintained at 10 bar and 1000 K. The reaction is, $$CO(g) + H_2O \rightarrow CO_2\ (g) + H_2(g)$$ Given that the equilibrium constant for the reaction at 1000 K is 1.5, Estimate the degree of conversion and composition of gases that leave the reactor. The reaction mixture is assumed to behave an ideal gas.	***CO6***	***PO3***	**10**

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