

GUJARAT TECHNOLOGICAL UNIVERSITY**M.E –IIst SEMESTER–EXAMINATION – JULY- 2012****Subject code: 1721604****Date: 10/07/2012****Subject Name: Property Prediction for Mixtures****Time: 10:30 am – 13:00 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1 (a)** A wild gasoline contains 15% CH₄, 10% C₂H₆, 30% C₃H₈, 5% i-C₄H₁₀, 10% C₄H₁₀, 15% C₅H₁₂ and 15% C₅H₁₂⁺(heavier) as feed. Vaporization is carried out at 232 psia (15.78 atm) and 50 °C. What is the composition of residue gasoline and that of the gas that is vaporized ? Also show that $\left(\frac{V}{L}\right)$ ratio of 0.429 is the suitable ratio. **07**

Use following data of vapour pressures for different components:

Component	CH ₄ ,	C ₂ H ₆ ,	C ₃ H ₈ ,	i-C ₄ H ₁₀ ,	C ₄ H ₁₀ ,	C ₅ H ₁₂ ,	C ₆ H ₁₄ ⁺
V.P. (psia)	4100,	750,	194,	78,	56,	19,	04

- (b)** Derive the following relationship for multi-component mixture: **07**

$$F_i \cdot P = L_i \left[P + P_i \left(\frac{V}{L} \right) \right]$$

All symbols used have conventional meanings.

- Q.2 (a)** Derive following relationship for properties Cp and Cv. **07**

$$C_p - C_v = -T \left(\frac{\delta V}{\delta T} \right)_P^2 \cdot \left(\frac{\delta p}{\delta v} \right)_T$$

- (b)** $C_p = \frac{(-V)}{\left(\frac{\delta T}{\delta P} \right)_H - \left(\frac{\delta T}{\delta P} \right)_S}$ and $\frac{\delta C_v}{\delta v} = T \cdot \left(\frac{\delta^2 P}{\delta T^2} \right)_v$ **07**

OR

- (b)** $ds = \frac{C_v}{T} \cdot \left(\frac{\delta T}{\delta P} \right)_v dp + \frac{C_p}{T} \cdot \left(\frac{\delta T}{\delta V} \right)_p dv$ and $\frac{\partial C_p}{\partial P} = -T \left(\frac{\partial^2 V}{\partial T^2} \right)_p$ **07**

- Q.3** Using concept of “Hypothetical Ideal Gas State”, explain in detail how to calculate any energy function at any temp (T) and pressure(P). **14**

Obtain relevant generalized equation for $\Delta H'_{T,P}$ under reduced conditions using an equation: $PV=ZRT$.

OR

- Q.3** Using concept of “Hypothetical Ideal Gas State”, explain in detail how to calculate any energy function at any temp (T) and pressure(P). **14**

Obtain relevant generalized equation for $\Delta S'_{T,P}$ under reduced conditions using an equation: $PV=ZRT$.

- Q.4 (a)** Discuss briefly about the “Use of Maxwell’s Relations in Properties Prediction”. **07**
(b) Write a note on – “Partial Molal Enthalpy (PMQ) and its estimation”. **07**

OR

- Q.4** Discuss the importance of property Prediction in Chemical Engineering, giving examples. **14**

- Q.5 (a)** Using concept of Hypothetically Ideal Component (Carlson and Coulburn Method) how constants of Van Laar’s Equation could be determined conveniently ? **07**
(b) Outline stepwise procedure in detail with relevant equations for calculation of H, S, U and G at any temp (T) and any pressure (P) under ideal gas conditions. **07**

OR

- Q.5 (a)** Discuss property prediction for viscosity. **07**
(b) Discuss property prediction for pressure. **07**

