Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Sem-II Remedial Examination December 2010

Subject code: 721604
Subject Name: Property Prediction for Mixtures

Date: 21 /12 /2010 **Time: 02.30 pm – 05.00 pm**
Total Marks: 60

Instructions:

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

Q.1 "Mathematical Model – based on "Hypothetical Ideal Gas State" could be utilized conveniently to calculate H(Enthalpy) at any temperature(T) and any pressure-(P). Explain the concept with relevant data, graphs etc. Hence or otherwise derive an expression for $\Delta H'_{T,P}$ using Vander Waal's equation of state. **12**

Q.2 **(a)** Give critical account of the following: **06**
Estimation of Partial Molal Quantity (PMQ) by Graphical Methodology

(b) In a proposal natural gasoline fractionating column, the product taken from top of the condenser will contain 20% mole ethane, 40% mole propane, 15% mole iso-butane and balance 25% mole n-butane. This material is completely liquefied in a condenser with cooling water at 20°c. Assuming 10°c approach, what must be pressure in the condenser? **06**
Use following data : K values at 30°c at different pressures as under:

Component	K at 150 Psia	K at 175 Psia	K at 200 Psia
Ethane	3.1	2.17	2.1
Propane	1.0	0.87	0.74
Iso-butane	0.46	0.39	0.34
n-butane	0.30	0.27	0.23

OR

(b) Outline various methods to evaluate constants of Van Laar's equations **06**

Q.3 Derive following thermodynamic relationships for properties **12**

(a) $$C_p - C_v = -T\left(\frac{\partial V}{\partial T}\right)_p^2 \cdot \frac{\partial p}{\partial V}\Bigg]_T$$

(b) $$C_p = \frac{T \cdot \frac{\partial V}{\partial T}\Big)_P}{\frac{\partial T}{\partial P}\Big)_S}$$

OR

Q.3 Derive following thermodynamic relationships for properties **12**

(a) $C_p = \alpha \cdot V \cdot T\frac{\partial P}{\partial T}\Big)_S$ where α = volumetric expansion coefficient.

(b)

$$\frac{C_P}{C_V} = \frac{\left(\frac{\partial P}{\partial V}\right)_S}{\left(\frac{\partial P}{\partial V}\right)_T}$$

Q.4 **(a)** Outline construction of T-X-Y diagram for immiscible systems with relevant thermodynamic relationships. **06**

(b) Write about Carlson and Coulburn Method of evaluation of activity coefficient at infinite dilution. **06**

OR

Q.4 **(a)** Prepare a temperature-composition diagram for benzene-water mixture at a total pressure of 760 mm from the following vapor-pressure data: **06**

t,^{o}c	Pure benzene, mmHg	Pure water, mmHg
50	269	93
60	389	149
70	547	233
75	640	285
80	754	355
90	1016	526
100	1344	760
110	1748	1075

(b) Give a brief account of viscosity of liquids **06**

Q.5 Discuss briefly the methods for the prediction of surface tension **12**

OR

Q.5 Discuss briefly the methods for the prediction of Diffusion coefficients. **12**

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