Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME – SEMESTER-II – • EXAMINATION – SUMMER 2017

Subject Code:2721604 **Date: 30/05/2017**

Subject Name: Property Prediction for Mixtures

Time: 2:30 PM-5:00PM **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) Discuss following equations to calculate saturated liquid densities in detail. **07**
1) Rackett equation 2) Yammada & Gunn 3) HBT correlation

Q-1 (b) Discuss elementary kinetic theory of gases and effect of intermolecular forces on viscosity of gases giving necessary assumptions. **07**

Q.2 (a) Explain concept of Partial Molal Quantities (PMQ) with special reference to energy function – Enthalpy (H). **07**

Q-2 (b) Estimate the viscosity of a mixture of acetic acid and acetone at 323 K that contains 70 mole % acetic acid. Viscosities of pure acetic acid and pure acetone are 0.798 and 0.241 respectively. **07**

Group	Notes	Values of Δ_i
$-CH_3$	---	- 0.100
> C=O	Ketones	1.046
-COOH	Acid with ketones	1.130

OR

Q-2 (b) Estimate the viscosity of SO_2 gas at atmospheric pressure and 300 °C by using Chung, et al. method. Given that T_c = 430.8 K ,V_c= 122 cm^3/mole , M= 64.065 and dipole moment is 1.6 debyes. ω = 0.257 . Assume κ = 0. Ω_v = 1.256 **07**

Q.3 (a) Discuss following methods to determine low pressure gas mixture viscosity in detail. **07**
1) Method of Wilke 2) Herning and Zipperer

(b) Estimate the thermal conductivity of CCl_4 at 293 K using **07**
1) Latini et. al method 2) Sastri Method.
Given that , Tc = 556.3 K , Tb = 349.79 K , M = 153.822 A* = 0.494 , α = 0 , β = 0.5 , γ = - 0.167, λb = 0.097 W/m.K ,
a = 0.16 n = 0.2

OR

Q.3 (a) Discuss estimaation of binary liquid diffusion coefficients at infinite dilution by following methods: **07**
1) Wilke and Chang 2) Tyn and Calus method

(b) Using Filippov's and Jamieson et.al's methods estimate the thermal conductivity of a liquid mixture of methanol and benzene at 273 K. The weight fraction of methanol is 0.4. At this temperature , the thermal conductivities of pure benzene and methanol are 0.152 and 0.210 W/m K. **07**

Q.4 (a) Outline stepwise procedure in detail with relevant equations for evaluation of H under different sets of conditions by approach- I. **07**

PTO

Q-4 (b) A wild gasoline contains 15% CH_4, 10% C_2H_6, 30% C_3H_8, 5% i-C_4H_{10}, **07**

10% C_4H_{10}, 15% C_5H_{12} and 15% $C_6H_{14}^+$(heavier) as feed. Vaporization is carried out at 232 psia (15.78 atm) and 50 ºC. What is the composition of residue gasoline and that of the gas that is vaporized ?

Use following data of vapour pressures at 50 ºC for different components:

Component	CH_4	C_2H_6	C_3H_8	i-C_4H_{10}	C_4H_{10}	C_5H_{12}	$C_6H_{14}^+$
V.P. (psia)	4100	750	194	78	56	19	04

OR

Q.4 **(a)** Discuss different corresponding state methods for estimation of surface tension of pure liquids. **07**

(b) Estimate the interfacial tension of a CO_2(1) and n-decane (2) mixture at 344.3 K and 11380 kPa and with x_1= 0.775. Data given: M_1= 44.010 M_2=142.285 . [P_1]= 73.5 and [P_2] = 446.2 , y_1 =0.986. **07**

Q.5 **(a)** Discuss theory of thermal conductivity for monoatomic gases and derive equation for Eucken Factor. **07**

(b) A ternary mixture containing molar 10% propane, 65%, n-butane and 25% n-pentane is vaporized at T=5 ^oC and P=600 mmHg. The value of equilibrium constants for phase equilibrium are K_1=6.34, K_2=1.37 and K_3=0.32 respectively. Show that the degree of vaporization (e) is 0.665. **07**

OR

Q.5 **(a)** Discuss general mixing and combining rules to determine mixture properties. **07**

(b) Discuss method of Grunberg and Nissan to estimate low temperature viscosity of liquid mixtures and discuss step wise procedure for group contribution method proposed by Isdale to estimate the binary interaction parameter Gij at 298 K. **07**

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