8. Write short notes on any *three* of the following :

(a) Residual Properties

(b) Activity Coefficients

(c) Criteria for feasibility of a chemical reaction

(d) Chemical Potential as criteria for Phase equilibrium. **15**

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B. Tech. EXAMINATION, Dec. 2018

(Fifth Semester)

(B. Scheme) (Main & Re-appear)

(CHE)

CHE311B

CHEMICAL ENGG. THERMODYNAMICS-II

Time : 3 *Hours*] [*Maximum Marks :* 75

Before answering the question-paper candidates should ensure that they have been supplied to correct and complete question-paper. No complaint, in this regard, will be entertained after the examination.

Note : Attempt any *Five* questions. Scientific Calculator is allowed.

Unit I

1. For a pure substance draw P-V, P-T, T-V and T-S diagram. **15**

2. Prove that the enthalpy change dH is given by the relation : **15**

$$dH = C_p dT + \left[V - T\left(\frac{\partial V}{\partial T}\right)_P \right] dp$$

Unit II

3. Define the following terms clearly : **15**

(a) Partial Molar properties

(b) Fugacity

(c) Chemical potential.

4. The experimental pressure-volume data for benzene at 754ºF from a low pressure up to 75 atm is represented by equation

$$\frac{V}{2T} = \frac{1}{P} - 0.0046$$

where P is in atm; V is in cu.ft. and T is in ºK. What is the fugacity coefficient of benzene at 75 atm, and 754ºF ? **15**

Unit III

5. The equilibrium constant of the reaction of oxidation of SO_2 to SO_3 at T = 650 K and 1 atm equals 629. Find the composition of the equilibrium mixture if the mixture fed to the contact process consists of 7% SO_2, 11% O_2 and 82% N_2. **15**

6. Prove that for the phase equilibrium

$$v_i^l = v_i^v$$

where

v_i^l = Chemical potential of component "i" in liquid phase for mixture.

v_i^v = Chemical potential of component "i" in vapour phase for mixture. **15**

Unit IV

7. At 303 K, the VP of Benzene and Toluene are 15.75 and 4.89 kPa. Determine the partial pressures and weight compositions of the vapour in equilibrium with liquid mixture consisting of equal weights of the two components. **15**