GUJARAT TECHNOLOGICAL UNIVERSITY ME – SEMESTER I (NEW) – • EXAMINATION – SUMMER 2016

Subject Code: 2711601

Date:17/05/2016

07

Subject Name: Advanced ThermodynamicsTime:02:30 pm to 05:00 pmTotal Marks: 70

Instructions:

- 1. Attempt all questions.
- 2. Make suitable assumptions wherever necessary.
- 3. Figures to the right indicate full marks.
- Q.1 (a) Write short note on Equilibrium conversion charts.
 - (b) The free energy change under standard conditions for ethyl benzene to 07 styrene and hydrogen is given by

 $\Delta G^{\rm o}_{\rm I} = 29720 - 31.1 \ (T)$

And for ethyl benzene to benzene and ethylene reaction is given by $\Delta G^{\circ}_{II} =$

27550 - 33.03(T).

Calculate the values of X_e at 800 K and 1 atm if both the reactions proceed simultaneously.

Note: ΔG° is in cal/gmol and T is in K.

- Q.2 (a) Derive an expression of equilibrium conversion as a function of temperature. 07
 - (b) A saturated liquid mixture, containing 45.1% propane, 18.3% iso-butane and 07 36.6% *n*-butane (by mole), is available at 40.8 bar a and 125.6° C (398.78 K). It is adiabatically flashed at 22 bar a and 93.1°C (366.25 K). At these conditions, K values are 1.42, 0.86 and 0.72, respectively. Calculate the liquid fraction and its composition after flashing.

OR

- (b) Explain the adiabatic flash calculations with block diagram and supporting 07 equations
- Q.3 Explain with neat sketch the working of Lithium Bromide water Vapour 14 absorption refrigeration cycle. Also discuss the importance of "Economizer" in the same cycle.

OR

- Q.3 Explain with neat sketch the working of Ammonia Vapour absorption 14 refrigeration cycle. Also discuss the importance of "Economizer" in the same cycle
- Q.4 Explain the PT FLASH Calculations and BUBL T Calculations with block 14 diagram and supporting equations

OR

Q.4 Explain the BUBL P Calculations and DEW P Calculations with block 14 diagram and supporting equations

Q.5 The free energy change under standard conditions for ethyl benzene to 14 styrene and hydrogen is given by

 $\Delta G^{\rm o}{}_{\rm I} = 29720 - 31.1 \ (T)$

And for ethyl benzene to benzene and ethylene reaction is given by $\Delta G^{\circ}_{II} =$

 $27550-33.03\;(T)\;.$

Calculate the values of X_e at 800 K and 1 atm if both the reactions proceed simultaneously.

Note: ΔG° is in cal/gmol and T is in K.

OR

Q.5 (a) A feed to a column has the composition given in the table below, and is a pressure of 7 14 bar and a temperature 60°C. Based on calculations verify that the given mixture is a Vapour-liquid mixture at given conditions.

Feed	kmol/h	K_{i}
ethane	20	3.8
propane	20	1.3
isobutene	20	0.43
n-pentane	<u>20</u>	0.16
Total:	<u>80</u>	

Also determined the flow rates and composition of vapour and liquid phases.

(b) Explain the working of vapour compression refrigeration cycle.

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