B.Tech. SEM -IV (Chemical) 2014 Course (CBCS) : WINTER - 2018

SUBJECT: CHEMICAL ENGINEERING THERMODYNAMICS – II

W-2018-2329

Day: Friday
Date: 16/11/2018

Time: 02.30 PM TO 05.30 PM
Max Marks: 60

N.B.:

1) All questions are **COMPULSORY**.
2) Figures to the right indicate **FULL** marks.
3) Draw neat and labeled diagram **WHEREVER** necessary.
4) Assume suitable data, if necessary.

Q.1 Define chemical potential. How chemical potential establishes a criteria of phase equilibrium. **(10)**

OR

Q.1 List the methods of determination of fugacity coefficient. Enumerate any one in detail. **(10)**

Q.2 Using criteria of phase equilibrium, show that the osmotic pressure over an ideal solution can be evaluated as: **(10)**

$$P_{osmotic} = \frac{RTx_A}{V_B}$$

x_A = mole fraction of solute
V_B = molar volume of solvent

OR

Q.2 **a)** State Duhem's theorem and justify it using phase rule. **(06)**

b) Elaborate constant temperature equilibrium using P-xy diagram. **(04)**

Q.3 Illustrate the determination of liquid phase property fugacity from VLE data. Write the expressions for same. **(10)**

OR

Q.3 The following VLE data was obtained for binary system: Acetone (1) and dichloroethylene (2). Test the thermodynamic consistency of the data using any suitable method **(10)**

x_1	0.023	0.053	0.357	0.516	0.883	0.976
γ_1	0.608	0.711	0.854	0.917	0.987	1.0
γ_2	0.993	0.974	0.934	0.891	0.781	0.694

P. T. O.

Q.4 Enumerate following terms: **(10)**
i) Reaction coordinate
ii) Stoichiometric number
iii) Chemical reaction equilibrium constant

OR

Q.4 Explain the criteria of chemical reaction equilibria. Derive an expression correlating reaction equilibrium constant and standard free energy change. **(10)**

Q.5 a) Elaborate "Combined physical and chemical equilibrium" **(05)**

b) Discuss the role of thermodynamics in industrial heterogeneous systems with suitable example. **(05)**

OR

Q.5 Calculate the composition at equilibrium assuming ideal gas behavior for following system. Seven moles of steam reacts with two mole methane according to the following reaction at 900K and 1 bar: **(10)**

$CH_4 + H_2O \rightarrow CO + 3H_2$ $K_1=0.60$

$CO + H_2O \rightarrow CO_2 + H_2$ $K_2=2.50$

Q.6 Explain the quantitative behavior of LLE using constant pressure liquid-liquid solubility diagram. **(10)**

OR

Q.6 Elaborate the following terms: **(10)**
i) Distribution coefficient
ii) Solubility parameter
iii) Binary solubility diagram
iv) Selection of solvent for extraction

* * * *