Code No: NR310802 **NR**

III B.Tech I Semester Supplementary Examinations, November 2006
CHEMICAL ENGINEERING AND THERMODYNAMICS-II
(Chemical Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. A reversible engine operating between a reservoir at 600 K and the ambient atmosphere at 300 K drives a refrigerator operating between 240 K and the ambient atmosphere. Determine the ratio of energy rejected by both the devices to the ambient atmosphere to the energy absorbed by the engine from the reservoir at 600K.

2. (a) Carnot refrigerator operates between -23^{o}C and 37^{o}C. Calculate the COP of the refrigerator.
   (b) Name three types of reversible process.

3. (a) Define the terms giving a suitable example of each of them : System, Closed System, Open System, Extensive Property, Intensive Property and Partial Molar Property.
   (b) For a system of definite composition, show that
   $n_1 d\overline{G_1} + n_2 d\overline{G_2} + - - - - - - n_i d\overline{G_i} + - - - - - = 0$
   (c) Explain the physical significance of partial molar property.

4. Discuss the enthalpy-concentration diagrams. What are the assumptions made in plotting these curves? Explain their utility and advantages. Discuss the effect of temperature and variation of these curves.

5. Determine expressions for G, H, S implied by the vander waals equation of state.

6. For the system chloroform (1) - ethanol (2) having 75 mole percent chloroform, the following data is available
   $t = 55C$, $P1^{Sat} = 82.5\,kPa$; $P2^{Sat} = 37.5\,kPa$
   second virial coefficients: B_{11}=-963 cu.cm/mol,
   $B_{22} = -1523\,CC/mol$; $B_{12} = 52\,CC/mol$
   Calculate the residual properties - volume, enthalpy & entropy.

7. Suppose that the adsorbate equation of state is given by $z = (1 - \beta n)^{-1}$, where β is function of T only. Find the implied adsorption isotherm and show under what conditions it reduces to the Langumir isotherm.

8. For the gas phase reaction $CO_2\,(g)+H_2\,(g) \Leftrightarrow CH_4OH\,(g)\ at\ 1000^0C$ and at 500 bar pressure, calculate the equilibrium composition using the following data: K=0.68 at 1000^{0}C.; The fugacity coefficients at this pressure:
   CO_2=0.99; H_2=1.15; CO=1.08; H_2O=0.86.

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