CODE NO : OR 3105862 OR

2005 JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY

III B.TECH I SEMESTER SUPPLEMENTARY EXAMINATIONS
THERMODYNAMICS - II
(CHEMICAL ENGINEERING)

/APRIL/MAY 2005

TIME: 3 HOURS
MAX MARKS: 70

Answer any FIVE Questions
All Questions carry equal marks

1. At steady state, a refrigeration cycle removes 150 kJ/min. of energy by heat transfer from a space maintained at -50o C and discharges energy by heat transfer to surroundings at 150 C. If the COP of the cycle is 30 % of that of a reversible refrigeration cycle operating between thermal reservoirs at these two temperatures, determine the power input to the cycle, in kW [14]

2. (a) Why sub-cooling is done after isothermal heat rejection at high temperature in a refrigeration cycle.

(b) All reversible heat pump cycles operating between the same two reservoirs have the same COP. Why? [7+7]

3. Define the terms : activity and activity coefficients. Show that the activity of the constituent 'i' of the given solution is proportional to its fugacity in that solution. Give a brief Discussion of variation of activity in liquid mixtures with temperature and pressure. [14]

4. Derive and discuss the Wilson equation as a model of solution behaviour for multicomponent system. Discuss the merits of this model over others. Explain its temperature dependence also. [14]

5. Calculate V, H and S for a binary mixture of nitrogen(1) ammonia (2) mixture with y1=0.27 and y2 = 0.73, t=40C and P = 325 bar using Redlich-Kwongg equation. Nitrogen : Tc = 126.2 K ; Pc = 33.9 bar Ammonia : Tc = 405.6 K ; Pc = 112.8 bar. [14]

6. Name the different types of binary mixtures in terms of solubility. What are the critical solution temperatures and the three phase temperature for a partially miscible liquid solution. Show them on diagram.

[14]

7. A mixture of N2,H2 and Argon in the mole ratio 1:3:2 enters a catalytic reactors for the synthesis of synthesis of ammonia. The reactor is maintained at 4000 C and 20 MPa. Estimate the degree of conversion (K = 1.96 × 10-4)

[14]

8. For the system diethy1 ketone (1) n-hexane(2), the Margules parameters are A21 = 0.596 and A = 1.153. Using modified Raoults law, prepare a p-x1-y1 diagram at 65 C. Saturation pressures of DEK and hexane are 29 and 90 kPa respectively.

[14]