



7. The relative stability of a system for transformations that occur at constant temperature and pressure is determined by its \_\_\_\_\_ CO4- R  
 (a) Energy (b) Helmholtz free energy (c) Entropy (d) Gibbs free energy
8. What happens to the entropy in a system with constant volume and constant internal energy during a spontaneous process? CO4- R  
 (a) decreases (b) increases  
 (c) First decreases then increases (d) remains same
9. Find the pH of a solution when 0.01 M HCl and 0.1 M NaOH are mixed in equal volumes CO5- R  
 (a) 12.65 (b) 1.04 (c) 7.0 (d) 2.0
10. Find the conjugate acid of  $\text{NH}_2^-$  CO5- R  
 (a)  $\text{NH}_3$  (b)  $\text{NH}_4\text{OH}$  (c)  $\text{NH}_4^+$  (d)  $\text{NH}_2^-$

PART – B (5x 2= 10 Marks)

11. State the Third law of thermodynamics. CO1- R
12. Explain UNIQUAC CO2- R
13. Define activity coefficient CO3- R
14. List out various types of azeotropes. CO4- R
15. Write the mass balance for flow process CO1- U

PART C - (5 x 16 = 80 Marks)

16. (a) Explain entropy changes in reversible processes CO1 -U (16)  
 Or  
 (b) Write the various statements of second law of thermodynamics CO1 -U (16)
17. (a) Sketch the PV diagram and PT diagram for the behavior of fluids CO2 -U (16)  
 Or  
 (b) Choose the appropriate procedure to prove the Maxwell Equation with the help of mnemonic diagram. CO2 -U (16)
18. (a) Explain about Carnot Cycle with neat diagram. CO3- U (16)  
 Or  
 (b) Explain about Thermodynamic Temperature cycle with neat diagram. CO3- U (16)

19. (a) The azeotrope of the ethanol – benzene system has a composition of 44.8% (mol ) ethanol with a boiling point of 341.4 k at 101.3 kpa. At this temp, the vapour Pressure of benzene is 68.9 kPa and the vapor pressure of ethanol is 67.4 kPa. Evaluate the activity coefficient in a solution containing 10% alcohol? CO4 -U (16)
- Or
- (b) Construct P-x-y diagram for Cyclohexane-benzene system at 313K given that at 313K the vapor pressure are  $P1s= 24.2$  kPa and  $P2s= 24.42$ kPa. The liquid phase activity coefficient are given by  $\ln \gamma_1=0.458 x_2^2$  and  $\ln \gamma_2=0.458 x_1^2$  CO4 -Ana (16)
20. (a) Using Redlich-Kwong equation calculate the pressure of 0.5kg gaseous NH<sub>3</sub> contained in a vessel of 0.03m<sup>3</sup> at constant T of 338K. Tc and Pc are 405.5K and 112.8 bar. CO5- U (16)
- Or
- (b) Derive the relationship between the equilibrium constant and standard free energy change CO5- U (16)

