Reg. No. : | | | | | | | | | | |

Question Paper Code: 94902

B.E./B.Tech. DEGREE EXAMINATION, MAY 2022

Fourth Semester

Chemical Engineering

19UCH402 – Chemical Engineering Thermodynamics

(Regulations 2019)

Duration: Three hours Maximum: 100 Marks

PART A - (10 x 1 = 10 Marks)

1. Which of the following processes is used to do maximum work done on the ideal gas that is compressed to half of its initial volume? CO1- R

   (a) isothermal (b) isochoric (c) isobaric (d) adiabatic

2. What is the ratio of Cp/Cv for gas if the pressure of the gas is proportional to the cube of its temperature and the process is an adiabatic process? CO1- R

   (a) 2 (b) 3/2 (c)1 (d) 4

3. The greater the temperature, the ____ is the vapour pressure. CO2- U

   (a) lower (b) higher

   (c) depends on the substance (d) none of the mentioned

4. Which of the following statement is true? CO2- R

   (a) saturation temperature is a function of pressure

   (b) saturation pressure is a function of temperature

   (c) both of the mentioned

   (d) none of the mentioned

5. On a Z-p compressibility factor chart as p approaches zero, at the Boyle temperature the slope of the isotherm is CO1- U

   (a) zero (b) negative (c) positive (d) unity

6. According to the equation of state, the Boyle temperature is CO1- U

(a) 2.56*Tc (b)2.50*Tc (c)2.52*Tc (d) 2.54*Tc

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 NH_2^- CO5- R

(a) NH_3 (b) NH_4OH (c) NH_4^+ (d) 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) The PVT behavior of nitrogen is represented by ideal gas equation. The heat capacity of gas are Cv= 20.8 and Cp= 29.1 kJ/kmol.K. The gas initially at 20 bar and 290K is undergoing a change of state to final condition of 1 bar and 350K. Determine the change in internal energy and change in enthalpy CO1 -U (16)

Or

(b) A system consisting of some fluid is stirred in a tank. The rate of work done on the system by stirrer is 2025hp. The heat generated due to stirring is dissipated to surroundings. If the heat is transferred to surroundings is 3400kJ/h, Analyze the change in internal energy. 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. 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 vap. Pr. Of benzene is 68.9 kPa and the vapor pressure of ethanol is 67.4 kPa. Evaluate the activity co-efficient 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= 24.42kPa. 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)	List out the various methods of consistency test for VLE data.	CO5- U	(16)
		Or		
	(b)	Derive the relationship between the equilibrium constant and standard free energy change	CO5- U	(16)

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