FirstRanker.com
Firstranker's choice
Seat No.: _____ www.FirstRanker.com Enrolment No. www.FirstRanker.com

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI(NEW) – EXAMINATION – SUMMER 2019

Subject Code:2163611 Date:16/05/2019

Subject Name:Chemical Engineering Thermodynamics & Kinetics

Time:10:30 AM TO 01:00 PM Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

			MARKS
Q.1	**(a)**	Explain the concept of Internal Energy	**03**
	(b)	Mention the distinctions between reversible and irreversible process	**04**
	(c)	Describe the first law of thermodynamics for a flow process.	**07**
Q.2	**(a)**	A gas occupying a volume of 0.2 m^3 at a pressure of 1 bar is expanded to a final pressure of 7.0 bar. The pressure of gas varies according to the relation P = 1200V + b, where P is in kPa and V is in m^3 and b is constant. Calculate work done by the gas.	**03**
	(b)	List thermodynamic properties of an ideal gas	**04**
	(c)	With a neat diagram explain PV diagram for pure fluids.	**07**
		OR	
	(c)	1 kg of certain gas is compressed reversibly according to a law PV = 0.25 where P is in bar and V is in m^3/kg. the final value is 1/4th of initial volume. Find the work done on the gas.	**07**
Q.3	**(a)**	One kilo mol of CO_2 occupies a volume of 0.381m^3 at 313 K. Compare the pressures predicted by (i) Ideal gas equation (ii) Vanderwaals equation	**03**
	(b)	Derive the expression for work done by an ideal gas in a adiabatic process.	**04**
	(c)	Estimate the value of Vanderwaals constants ‘a’ and ‘b’ interms of critical temperature and pressure.	**07**
		OR	
Q.3	**(a)**	A reservoir at 600 K is transferring 1000 J of heat to an engine that is operating in Carnot cycle. The engine rejects heat to a reservoir at 300 K. Determine the thermal efficiency of the cycle and work done by the engine.	**03**
	(b)	Show that violation of Kelvin statement results in violation of Clausius statement of Second law of Thermodynamics.	**04**
	(c)	With help of thermodynamic diagram describe the various process involved in a Carnot Cycle.	**07**
Q.4	**(a)**	Write a short note on entropy and irreversibility	**03**
	(b)	Describe the classification of themodynamic properties	**04**
	(c)	Establish the following Maxwells correlation (i) $\left(\frac{\partial T}{\partial V}\right)_S = -\left(\frac{\partial P}{\partial S}\right)_V$ (ii) $\left(\frac{\partial T}{\partial P}\right)_S = -\left(\frac{\partial V}{\partial S}\right)_P$	**07**
		OR	
Q.4	**(a)**	Find the fugacity coefficient at 1, 5 and 10bar for a gas that follows equation of state PV = RT(1 – 0.00513P)where P is the pressure in bar.	**03**
	(b)	Define an ideal solution. Substantiate the reasons resulting for non-ideality in solutions.	**04**
	(c)	Mention various thermodynamic diagrams. Explain any one with a neat diagram.	**07**

www.FirstRanker.com

www.FirstRanker.com

FirstRanker.com
Firstranker's choice
www.FirstRanker.com www.FirstRanker.com

Q.5	**(a)**	What is meant by Azeotropes. Mention its various types	**03**
	(b)	An equimolar solution of benzene and toluene is totally evaporated at a constant temperature of 363 K. At this temperature the vapour pressures of benzene and toluene are 135.4 and 54 kPa respectively. What are the pressures at beginning and at end of vaporization process?	**04**
	(c)	Describe T-x-y diagrams mentioning the effect of pressure on T – x – y	**07**

OR

Q.5	**(a)**	Derive the relationship between equilibrium constant and standard free energy change?	**03**
	(b)	Discuss the criteria for Chemical reaction Equilibria?	**04**
	(c)	The standard heat of formation and standard free energy of formation of ammonia at 298K are -46100 J/mol and -16500 J/mol. Calculate the equilibrium constant for the reaction $N_2 + 3H_2 \rightleftharpoons 2NH_3$ at 500 K assuming that the standard heat of reaction is constant in the temperature range 298 to 500 K	**07**

****

www.FirstRanker.com

www.FirstRanker.com