## GUJARAT TECHNOLOGICAL UNIVERSITY BE - SEMESTER-IV • EXAMINATION – WINTER 2013

BE - SEMESTER-IV • EXAMINATION – WINTER 2013			
Subject Code: 140502 Date: 23-12-2013			
Subject Name: Chemical Engineering Thermodynamics -I			
Time: 02:30 pm to 05:00 pm Total Marks: 70			
Instructions:			
	1.	Attempt all questions.	
	2. 3.	Make suitable assumptions wherever necessary. Figures to the right indicate full marks.	
Q.1	(a) (b)	Derive equation for first law of thermodynamics for a steady state flow process. Discuss briefly :1) State and Path functions 2)Closed and Open systems	07 07
Q.2	(a) (b)	Discuss PVT behavior of pure substances. Heat is transferred to10 kg of air which is initially at 100 kpa and 300 K until its temperature reaches 600 K. Determine the change in internal energy and change in enthalpy , amount of heat supplied and the work done for a Constant volume process. Assume air as an ideal gas. Given that : R=8.314 kJ / kmol K, Cp=29.099 kJ / kmol K, Cv =20.785 kJ / kmol K and molecular weight of air =29	07 07
	(b)	$\label{eq:order} \begin{array}{c} \textbf{OR} \\ \text{Nitrogen gas is initially at 10 bar and 280 K is under going a change of state to the final condition of 1 bar and 340 K. Assuming ideal gas condition, calculate change in internal energy and change in enthalpy. Given that: R=8.314 kJ / kmol K, Cp=29.1 kJ / kmol K, Cv =20.8 kJ / kmol K . \end{array}$	07
Q.3	(a) (b)	Discuss Virial equations and their applications. Write short note: Ideal gas temperature scale.	07 07
0.2	(a)	<b>OR</b> Ear on adjustic process prove that $\mathbf{D}\mathbf{V}^{\prime}$ =constant	07
Q.3	(a) (b)	For an adiabatic process prove that $PV^{\gamma}$ = constant Discuss effect of temperature on heat of reaction and derive necessary equation.	07 07
Q.4	(a) (b)	State general statements for the second law of thermodynamics. Explain and prove Carnot's principle with neat sketch. <b>OR</b>	07 07
Q.4 Q.4	(a) (b)	Discuss important properties of a refrigerant. Write on Multistage compression.	07 07
Q.5	(a) (b)	State types of thermodynamic diagrams and discuss any one of them. Oil at 500 K is to be cooled at a 5000 kg/h in a counter-current exchanger using cold water available at 295 K. A temperature approach of 10 K is to be maintained at both ends of the exchanger. The specific heats of oil and water are 3.2 and 4.2 kJ/kg K. Calculate total entropy change in the process. <b>OR</b>	07 07
Q.5	(a) (b)	Prove Maxwell's equations. A refrigeration machine operating at a condenser temperature at 290 K needs 1kW of power per ton of refrigeration .Determine:1) COP 2) heat rejected to the condenser 3) the lowest temperature that can be maintained. Given that :1 Ton of refrigeration =12660 kJ/h=3516.67 W	07 07

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