Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–III(New) • EXAMINATION – WINTER 2016

Subject Code:2130405 **Date:02/01/2017**

Subject Name:Thermodynamics

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		**Short Questions**	**14**
	1	State Zeroth law of thermodynamics	
	2	Define internal energy.	
	3	Define Standard heats of combustion.	
	4	Define Heat Pump.	
	5	Write three different units of pressure.	
	6	What is Refrigeration?	
	7	Define heat capacity.	
	8	Explain system and surroundings.	
	9	Definition of entropy	
	10	Define Standard heats of formation.	
	11	Define Sensible heat.	
	12	What is fundamental property.	
	13	State first law of thermodynamics	
	14	What do you mean by equation of state?	
Q.2	**(a)**	Prove that C_p-C_v = R	**03**
	(b)	Give various statements of the second law of thermodynamics.	**04**
	(c)	Define Refrigerator capacity and Coefficient of performance.	**07**
		OR	
	(c)	Drive the equation for enthalpy and Entropy as functions of temperature and pressure	**07**
Q.3	**(a)**	Explain heat engine.	**03**
	(b)	Explain the factors affecting the choice of a refrigerant with examples.	**04**
	(c)	Explain PVT behaviour of pure substances with the help of PT and PVdiagrams.	**07**
		OR	
Q.3	**(a)**	Starting from basic principles, obtain different forms of virial equations.	**03**
	(b)	Define the first law of thermodynamics. What are its limitations?	**04**
	(c)	Describe with neat sketch explain the Vapor compression cycle.	**07**
Q.4	**(a)**	Define Hess law and write it applications.	**03**
	(b)	Derive the equaton of efficiency for heat engine.	**04**
	(c)	A steel casting [*Cp* = 0.5 kJ kg-1 K-1] weighing 40 kg and at a temperature of 450°C is quenched in 150 kg of oil [*Cp* = 2.5 kJ kg-1 K-1] at 25°C. If there are no heat losses, what	**07**

is the change in entropy of i) the casting ii) the oil, and iii) both considered together?

OR

Q.4 **(a)** For an Ideal gas with constant heat capacities, show that… For a temperature increase from T_1 to T_2, ΔS of the gas is greater when the changes occurs at constant pressure than when it occurs at constant volume. **03**

(b) Derive the following thermodynamic relationship **04**

$$dS = C_P \frac{dT}{T} - \left(\frac{\partial V}{\partial T}\right)_P dP$$

(c) For an ideal gas prove that $\frac{\Delta S}{R} = \int_{To}^{T} \frac{C_V^{ig}}{R} \frac{dT}{T} + \ln \frac{V}{Vo}$ **07**

Q.5 **(a)** Explain the term 'temperature'. Mention different units of temperature and relations among various temperature scales. **03**

(b) Derive the following Maxwell's equation from the first inciple. **04**

$$\left(\frac{\partial T}{\partial V}\right)_S = -\left(\frac{\partial P}{\partial S}\right)_V$$

(c) Explain cubic equations of state and derive expressions of constants a and b of Vanderwaal's equations of state in terms of critical properties of a substance. **07**

OR

Q.5 **(a)** Explain intensive and extensive properties of thermodynamics. **03**

(b) One kilo mol CO_2 occupies a volume of 0.381 m^3 at 313 K. Compare the pressure given by **04**
(a) Ideal gas equation
(b) Van der Waals equation
Take the van der Wasls equation to be a= 0.365 Nm^4/mol^2 and b = 4.28×10^{-5} m^3/mol.

(c) Derive a mathematical expression of the first law of thermodynamic for a Flow process. **07**

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