Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV EXAMINATION – SUMMER 2016

Subject Code:141903 **Date:30/05/2016**

Subject Name:Engineering 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.**

Q.1	**(a)**	Differentiate between the following: 1. Statistical and classical thermodynamics 2. Open system and control volume 3. Intensive properties and extensive properties	**07**
	(b)	Write down the Van der Waals equation of state. How does it differ from the ideal gas equation of state? What is the force of cohesion? What is co-volume?	**07**
Q.2	**(a)**	Air at a temperature of 15 °C passes through a heat exchanger at a velocity of 30 m/s where its temperature is raised to 800 °C. It then enters a turbine with the same velocity of 30 m/s and expands until the temperature falls to 650 °C. On leaving the turbine, the air is taken at a velocity of 60 m/s to a nozzle where it expands until the temperature has fallen to 500 °C. If the airflow rate is 2 kg/s, calculate (a) the rate of heat transfer to the air in the heat exchanger, (b) the power output from the turbine assuming no heat loss and (c) the velocity at exit from the nozzle, assuming no heat loss. Take the enthalpy of air as $h = C_p t$, where Cp is the specific heat = 1.005 kJ/kg K and t is the temperature.	**07**
	(b)	Derive the steady flow energy equation for a single stream entering and a single stream leaving a control volume and explain the various terms in it.	**07**
		OR	
	(b)	Explain the control volume technique in a variable flow process.	**07**
Q.3	**(a)**	Establish the equivalence of Kelvin-Planck and Clausius statements.	**07**
	(b)	What is the Carnot cycle? What are the four processes which constitute the cycle?	**07**
		OR	
Q.3	**(a)**	Show that the efficiency of a reversible engine operating between two given constant temperatures is the maximum.	**07**
	(b)	Explain the operation of a cyclic refrigerator plant with a block diagram.	**07**
Q.4	**(a)**	Compare the Carnot and Rankine cycle with the help of T-s diagram.	**07**
	(b)	What are the three basic components of gas turbine plant? What is the air standard cycle of such a plant? What are the processes it consists of?	**07**
		OR	
Q.4	**(a)**	With the help of schematic diagram, derive an expression for Rankine cycle. Also represent it on p-v, T-s and h-s diagram.	**07**
	(b)	Compared the Brayton and Otto cycle with the help of p-v and T-s diagram.	**07**
Q.5	**(a)**	Write down the first and second Tds equations, and derive the expression for the difference in heat capacities, C_p and C_v. What does the expression signify?	**07**
	(b)	Explain the terms: (1) Enthalpy of formation (2) Adiabatic flame temperature	**07**
		OR	
Q.5	**(a)**	What is Joule Thomson coefficient? Why is it zero for an ideal gas?	**07**
	(b)	What is Calorific value (CV) of the fuel? Explain Junkers gas calorimeter.	**07**

****