GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER– IV (Old) EXAMINATION – WINTER 2019

Subject Code: 141903   **Date: 10/12/2019**

Subject Name: Engineering Thermodynamics

Time: 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 closed system 3. Intensive properties and extensive properties	**07**
	(b)	Explain first law of thermodynamics for closed system undergoing a cycle.	**07**
Q.2	**(a)**	What is difference between heat and work? Show that heat is a path function and not a property.	**07**
	(b)	Derive the steady flow energy equation for a single stream entering and a single stream leaving a control volume and reduce it for turbine.	**07**
		OR	
	(b)	An engine manufacturer claims to have developed a heat engine with following conditions: Power developed = 75 kW, fuel burnt = 5 kg/hour, heating value of fuel = 73000 kJ/kg, temperature limits = 1000 and 400 K. is the claim of manufacturer is true or false? Justify your answer.	**07**
Q.3	**(a)**	Define COP. Prove that $COP_{HP} = COP_R + 1$	**07**
	(b)	Prove equivalence of Kelvin-Planck's and Clausius' statements.	**07**
		OR	
Q.3	**(a)**	Show that the efficiency of a reversible engine operating between two given constant temperatures is the maximum.	**07**
	(b)	A lump of steel of mass 10 kg at 627°C is dropped in 100 kg of oil at 30°C. the specific heats of steel and oil are 0.5 kJ/kgK and 3.5 kJ/kgK respectively. Calculate entropy change for steel, oil and the universe.	**07**
Q.4	**(a)**	Derive expressions for availability of steady flow open system.	**07**
	(b)	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**
		OR	
Q.4	**(a)**	Derive Maxwell's equations.	**07**
	(b)	Derive equation for air standard efficiency of Brayton cycle.	**07**
Q.5	**(a)**	Write down the first and second TdS equations, and derive the expression for the difference in heat capacities, Cp and Cv.	**07**
	(b)	What is Joule Thomson coefficient? Explain it's significance.	**07**
		OR	
Q.5	**(a)**	Describe the method of determination of heating value of solid fuel using Bomb calorimeter.	**07**
	(b)	A 1.5 kg mixture of two gases in 40% and 60% proportion is stored at 20° C in a closed vessel of 5 m^3 capacity. If the gas constant for the constituent gases is 287 kJ/kgK and 294 kJ/kgK, calculate partial pressure, total pressure and gas constant pressure for the mixture.	**07**

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