

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: **07**
 1. Statistical and classical thermodynamics
 2. Open system and closed system
 3. Intensive properties and extensive properties
- (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 m³ 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**
