GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–IV (OLD) EXAMINATION – WINTER 2021

Subject Code:141903   **Date:01/01/2022**
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.**
4. **Simple and non-programmable scientific calculators are allowed.**
5. **Use of Steam Table and Gas table is permitted.**

Q.1	**(a)**	Explain Ist law of thermodynamics. Prove that internal energy is a property.	**07**
	(b)	Define thermodynamic system. Classify it with proper examples.	**07**
Q.2	**(a)**	Derive steady flow energy equation. Reduce it for nozzle clearly stating assumptions.	**07**
	(b)	An M.S. steel piece of 5 kg mass is heated to 115° C and dropped into an insulated vessel containing 30 kg of water at 20° C. due to heat transfer between hot M.S. piece and water, temperature of water rises by 3.5° C. Calculate specific heat of M.S. piece. Take specific heat of water = 4.18 kJ/kg C.	**07**

OR

	(b)	Write Kelvin-Planck's and Clausius' statements for IInd law of thermodynamics. Prove that violation of Kelvin-Plank statement leads to violation of Clausius statement.	**07**
Q.3	**(a)**	Prove that all reversible engines working between two constant temperature reservoirs have the same efficiency.	**07**
	(b)	State the principle of increase of entropy. List the four application of entropy principle.	**07**

OR

Q.3	**(a)**	A 3 kg Aluminum block at 200° C & 1 kg of copper block at 100° C are brought into contact but kept isolated from surrounding. Find change in entropy for both blocks and total entropy change when both attain same temperature. Take Cp for Al = 0.9 kJ/kg K and Cp for Copper = 0.4 kJ/kg K.	**07**
	(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 K and 400 K. Is the claim is true or false? Give reason for your answer.	**07**
Q.4	**(a)**	Derive equation for exergy of finite heat capacity source at temperature 'T'. Also differentiate between available and unavailable energy.	**07**
	(b)	Compare Otto, Diesel and Dual cycle for (i) Same compression ration and heat supplied with necessary diagrams.	**07**

OR

Q.4	**(a)**	Explain Rankine cycle with necessary diagrams.	**07**
	(b)	Explain ideal regenerative cycle. Explain why it is impractical in practice?	**07**
Q.5	**(a)**	Derive Vander Waal's equation.	**07**
	(b)	State and explain the Gibbs-Dalton law of partial pressures.	**07**

OR

Q.5	**(a)**	With neat sketch, explain the working of Junker's gas calorimeter.	**07**
	(b)	Derive Maxwell's equations.	**07**