Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV • EXAMINATION – SUMMER • 2014

Subject Code: 141903 **Date: 16-06-2014**

Subject Name: Engineering Thermodynamics

Time: 10:30 am - 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)** The minimum pressure and temperature in an otto cycle are 100 kpa and 27^0c. The amount of heat added to the air per cycle is 1500 kj/kg. Determine the pressures and temperatures at all points of the air standard otto cycle if compression ratio is 8. Also calculate the specific work and thermal efficiency of the cycle. Assume Cv=0.72 kj/kg k and γ= 1.4. **07**

(b) In steam power plant 1 kg of water per second is supplied to the boiler. The enthalpy and velocity of water entering the boiler are 800 kj/kg and 5 m/s. the water receives 2200 kj/kg of heat in the boiler at constant pressure. The steam after passing through the turbine comes out with a velocity of 50 m/s, and its enthalpy is 2520 kj/kg. The inlet is 4 m above the turbine exit. Assuming the heat losses from the boiler and the turbine to the surroundings are 20 kj/sec. calculate the power developed by the turbine. Consider the boiler and turbine as single system. **07**

Q.2 **(a)** 1 kg of ice at 0^0c is mixed with 12 kg of water at 27^0c. Assuming the surrounding temperature as 15^0c, calculate the net increase in entropy and unavailable energy when the system reaches common temperature. **07**

(b) Steam at 50 bar, 400^0c expands in a rankine cycle to 0.34 bar. For a mass flow rate of 150 kg/sec of steam, determine (1) Power developed (2) Thermal efficiency and (3) Specific steam consumption. **07**

OR

(b) A reversible heat engine absorbs heat from two thermal reservoirs at constant temperatures of 800 k and 550 k, rejects heat to a reservoir at 300 k, calculate the thermal efficiency and heat supplied by each thermal reservoirs when the engine produces 80 kw and rejects 55 kj/sec to heat sink. **07**

Q.3 **(a)** Explain microscopic and macroscopic point of view of thermodynamics and also discuss open, close and isolated system. **07**

(b) Prove that internal energy is a property of the system. Also explain perpetual motion machine of first kind. **07**

OR

Q.3 **(a)** Derive general steady flow energy equation. **07**

(b) What is difference between heat and work? Show that heat is a path function and not a property. **07**

Q.4 **(a)** What do you mean by the term entropy? What are the characteristics of entropy? How the principle of entropy is used to determine whether the process path is reversible, irreversible or impossible. **07**

(b) Define available energy, unavailable energy, dead state, reversibility, irreversibility and effectiveness. **07**

OR

Q.4	**(a)**	State and prove clausious theorem.	**07**
	(b)	Carnot cycle is not practical, Justify. State carnot theorem and perpetual motion machine of second kind.	**07**
Q.5	**(a)**	Derive expressions for availability of steady flow open system.	**07**
	(b)	Derive expression for air standard efficiency of diesel cycle.	**07**

OR

Q.5	**(a)**	Compare otto, diesel and dual cycle for (1) Constant maximum pressure and heat input. (2) Same maximum pressure and temperature.	**07**
	(b)	State and explain gibbs-dalton law.	**07**

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