Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–III • EXAMINATION – WINTER • 2014

Subject Code: 2131905 Date: 03-01-2015

Subject Name: Engineering Thermodynamics

Time: 02.30 pm - 05.00 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 followings; **07**

1) Intensive properties and extensive properties,
2) Point function and path function ,
3) Microscopic approach and macroscopic approach,
4) Pure substance and working substance.

(b) Derive equation for a) filling of a tank and b) emptying of tank. **07**

Q.2 **(a)** State the first law of thermodynamics, its applications and limitations. **07**

(b) Two Carnot engines work in series between the source and sink temperatures of 550K and 350K. If both engines develop equal power, derive the formulae to find out the intermediate temperature and determine the intermediate temperature also. **07**

OR

(b) Prove that all reversible engines operating between operating between same temperatures limits have are equally efficient. **07**

Q.3 **(a)** Prove that entropy is a property of system. **03**

(b) With usual notations prove that $\Phi\delta Q/T <= 0$. **04**

(c) Steam at 6.87bar, 205^0C enters in an insulated nozzle with a velocity of 50m/sec. It leaves at a pressure of 1.37bar and a velocity of 500m/sec. Determine the final enthalpy of the steam. Also clearly mentioned the applied assumptions. **Use of steam table is permitted.** **07**

OR

Q.3 **(a)** Explain Clausius theorem. **07**

(b) Define the following terms: **07**

1) Critical point temperature, 2) thermodynamic equilibrium ,3) Dead state of a given system,4) Availability, 5) Irreversibility, 6) enthalpy,7) entropy.

Q.4 **(a)** State various methods to improve efficiency of Rankine cycle. With suitable diagrams, explain any two of them. **07**

(b) In an I C Engine working with the Otto cycle, the cylinder diameter is 250mm and a stroke is 375mm. If the clearance volume is 0.00263 m^3, and the initial pressure and temperature are 1bar and 50^0C, calculate the air standard efficiency and mean effective pressure of the cycle. The maximum cycle pressure is limited to 25bar. **07**

OR

Q.4 **(a)** With help of T-s diagram, explain the effects of variables on efficiency of the Rankine cycle. **07**

	(b)	In a Rankine cycle, the steam at inlet to the turbine is saturated at pressure of 35bar and exhaust pressure is 0.2bar. Determine: 1)the pump work, 2) the turbine work, 3) the Rankine efficiency, 4) the quality of steam at the end of expansion. Assume flow rate of 9.5kg/sec. **Use of steam table is permitted.**	**07**
Q.5	**(a)**	State various methods to improve efficiency of Brayton cycle. With suitable diagrams, explain any two of them.	**07**
	(b)	Derive Vander waal's equation.	**07**
		OR	
Q.5	**(a)**	Explain Carnot vapor cycle .State and explain required modifications with help of suitable diagrams to make the cycle feasible.	**07**
	(b)	State and explain Dalton's law of partial pressure and Avogadro's law.	**07**

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