Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

P.D.D.C. Sem- I Regular / Remedial Examination January. 2011

Subject code: X11902

Subject Name: Engineering Thermodynamics

Date: 12 / 01 /2011 **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)** Define the following terms : **07**
(1) Open system (2) Closed system (3) Isolated system
(4) Extensive properties (5) Intensive properties (6) Cyclic process and
(7) Quasi static process

(b) State and explain first law of thermodynamics. **07**

Q.2 **(a)** Write two major statements of second law of thermodynamics and explain. How the concept of thermal efficiency and co-efficient of performance are generated. **07**

(b) Carnot cycle and derive an expression for its efficiency. **07**

OR

(b) A reversed Carnot cycle operating as refrigerator has refrigerating capacity of 100 kW operating between temperature limits of -20°C and +35°C. **07**
Determine:(1) COP (2) Power input and (3) COP as heat pump.

Q.3 **(a)** State and prove Clausius Inequality. **07**

(b) 300 kJ/s of heat is supplied at a constant fixed temperature of 290°C to a heat engine. The heat rejection takes place at 8.5°C The following results were obtained (1) 215 kJ/s heat is rejected (2) 150 kJ/s heat is rejected and (3) 75kJ/s heat is rejected. Classify which of the result report at reversible cycle or irreversible cycle or impossible cycle; give your comments on it. **07**

OR

Q.3 **(a)** Air at 1 bar and 22°C, initially occupying a cylinder volume of 0.015m^3 is compressed reversibly and adiabatically by a piston to a pressure of 7 bar. Calculate: **07**
(1) Final temperature (2) Final volume and (3) Work done

(b) Steam enters a nozzle at a pressure of 7 bar and 200°C with initial enthalpy 2850 kJ/kg and leaves at a pressure of 1.5 bar. The initial velocity of steam at the entrance is 40 m/sec and exist velocity from the nozzle is 700 m/sec. The mass flow rate through the nozzle is 1400 kg/hr. The heat loss from the nozzle is 1105 kJ/hr. **07**
Determine: (1) Final enthalpy of steam and (2) Nozzle area if specific volume is 1.24 m^3/kg.

Q.4 **(a)** Derive an expression for air standard efficiency for Otto cycle with usual notations. **07**

(b) An engine is working on Otto cycle. The pressure and temperature at the beginning of compression stroke are 1bar and 300K respectively and at the end of compression stroke temperature is 600K. At the end of constant volume heat addition process temperature is 1800K. Calculate : **07**
(1) Compression ratio (2) Air standard efficiency (3) Heat supplied per kg of air and (4) Heat rejected per kg of air.

OR

Q.4	**(a)**	State and derive Maxwell's relations, give their importance	**07**
	(b)	Explain the Joule Thomson experiment and define Joule Thomson coefficient.	**07**
Q.5	**(a)**	Write a short note on "Bomb calorimeter"	**07**
	(b)	Explain the following in brief: (1) Higher calorific value (2) Lower calorific value (3) Enthalpy of formation	**07**

OR

Q.5	**(a)**	Explain Gibb's Dalton law of partial pressure.	**07**
	(b)	State the Vander Waal's equation as applied to real gases and derive the equation in reduced form of properties.	**07**

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