Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC - SEMESTER–I • EXAMINATION – SUMMER 2013

Subject Code: X11902 **Date: 11-06-2013**

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)** What do you mean by thermodynamics? Explain the concepts of microscopic and macroscopic point of view of thermodynamics. **07**

(b) Define the following terms:- **07**
(1) Process (2) Cycle (3) Pure substance
(4) Control volume (5) Closed System
(6) Intensive Properties (7) Extensive Properties

Q.2 **(a)** Explain Joule's Experiment for first law of thermodynamics with neat sketch. **07**

(b) Derive and explain steady flow energy equation. **07**

OR

(b) Explain the concept of perpetual motion machine of the first kind. **07**

Q.3 **(a)** What are the various limitations of first law of thermodynamics? Explain in detail with various examples. **07**

(b) An Engine operating on Carnot cycle works within temperature limits of 700 K and 350 K. If the engine receives 1800 kJ of heat , Calculate the following:- **07**
(1) Thermal efficiency
(2) Work done
(3) Heat Rejected.

OR

Q.3 **(a)** In a gas turbine unit, the gas flow through the turbine is 14 kg/s and the power developed by the turbine is 11500 kW. The enthalpies of the gases at the inlet and outlet are 1250 KJ/kg and 380 kJ/kg respectively, and the velocity of gases at the inlet and outlet are 45m/s and 100m/s respectively. Calculate the following:- **07**
(1) The rate at which heat is rejected to the turbine
(2) The area of inlet pipe given that the specific volume of the gases at the inlet is 0.40 m^3/kg.

(b) 1. State Kelvin-Planck and Clausius statement for second law of thermodynamics. **07**
2. State and prove Carnot's theorem.

Q.4 **(a)** What do you mean by Availability? Derive an expression for availability in non-flow systems. **07**

(b) Determine the air standard efficiency of Otto cycle from the following data. **07**
Bore of the cylinder = 13 cm
Stroke Length = 12 cm
Clearance volume = 300 cm^3 , Take γ=1.4

OR

Q.4 **(a)** Compare the Carnot Cycle with Rankine Cycle. **07**

Q.4 **(b)** A vessel of volume 0.38 m^3 consists of 0.40 kg of CO and 1 kg of Air at 14 $^{\circ}$C.Calculate **07**

(1) The partial pressure of each constituent

(2) Total pressure in the vessel.

The air contains 23 % O_2 and 76.9 % N_2 by mass.

Take the molecular mass of CO, O_2, N_2 as 28, 32 and 28 kg/kg mole respectively.

Take Universal Gas constant, R=8.3143 kJ/kg mol k

Q.5 **(a)** What do you mean by Calorific value? Explain Junker's Gas Calorimeter with neat sketch. **07**

(b) State and explain the following:- **07**

(1) Avogadro's law (2) Gibbs-Dalton Law

OR

Q.5 **(a)** Explain Diesel Cycle with neat sketch and derive the equation for the efficiency of Diesel cycle. **07**

(b) State and explain the following in brief:- **07**

(1) Third Law of thermodynamics

(2) Entropy and disorder

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