Enrollment No: _____ **Exam Seat No:_____**

C.U.SHAH UNIVERSITY

Summer Examination-2017

Subject Name: Thermodynamics

Subject Code: 4TE03TDY1 **Branch: B.Tech (Mechanical)**

Semester: 3 **Date: 29/03/2017** **Time: 10:30 To 01:30** **Marks: 70**

Instructions:

(1) Use of Programmable calculator & any other electronic instrument is prohibited.
(2) Instructions written on main answer book are strictly to be obeyed.
(3) Draw neat diagrams and figures (if necessary) at right places.
(4) Assume suitable data if needed.

Q-1 **Attempt the following questions:** **(14)**

a) A system has single phase is called
(A) Isolated (B) Closed (C) Homogeneous (D) Heterogeneous

b) Second law of thermodynamics defines
(A) Internal energy (B) Entropy (C) Heat (D) Work

c) The first law of thermodymics is expressed by equation.
(A)Q = W (B) Q = U (C) Q = H (D) Q = pV

d) Steady flow energy equation of throttling process for ideal gas
(A)h1 = h2 (B) T1 = T2 (C) u1 = u2 (D) None of the above

e) If the temperature of source is increased the efficiency of the Carnot engine
(A) Decrease (B) Increase (C) Not change (D)Depend on other

f) For a reversible process net entropy is
(A) Zero (B) Positive (C) Negative (D) None of the above

g) The difference of reversible maximum work and the actual work called……
(A) Availability (B) Unavailability (C) Reversibility (D) Irreversibility

h) Throttling is constant …….. Process.
(A) Temperature (B) Enthalpy (C) Entropy (D) Pressure

i) The ideal cycle on which a steam turbine work is
(A) Carnot Cycle (B) Rankin Cycle (C) Otto Cycle (D) Joule Cycle

j) The Rankin cycle as compared to Carnot cycle has…… work ratio
(A) Same (B) Low (C) High (D) All of the above

k) A fuel is always reached with……during combustion and produce heat.
(A) Oxygen (B) Water (C) Nitrogen (D) Carbon

l) The calorific value of gaseous fuel is given by unit
(A) KJ/kg (B) KJ/m^3 (C) KJ/mole (D) KJ/K

m) One kg mole of a gas occupies a volume of ……at NTP
(A) 22.4 m^3 (B) 21.8 m^3 (C) 20.4 m^3 (D) 23.8 m^3

n) The equation of state per kg of ideal gas is given by
(A) Pv = RT (B) p^2v = RT (C) pv = R^2 T (D) p^2v^2 = RT

Attempt any four questions from Q-2 to Q-8

Q-2 **Attempt all questions** **(14)**

a) Explain with neat sketch different thermodynamics system

b) A cylinder contains 0.45m3 of gas at 1X105 N/m2 and 800°C. The gas is compressed

to volume of 0.12m3. The final pressure being 5X105 N/m2. Assume ϒ=104,

R=294.2J/kg C. Calculate mass of gas index of compression, increase in internal energy of gas, heat rejected by gas during compression.

Q-3 **Attempt all questions** **(14)**

a) 1 kg Gas is contained in a piston cylinder arrangement at a pressure 8br and volume 0.045m3. The fluid is allowed to expand reversibly according to PV 1.8 = C unit the volume becomes two times of its initial value. The fluid is than cooled reversibly at constant pressure until the piston riches its original position. Finally the head addition takes place until the gas pressure increase to initial pressure. Calculate net work done by gas during cycle.

b) Derive general steady flow energy equation (SFEE).

Q-4 **Attempt all questions** **(14)**

a) State and prove the Clausius theorem.

b) 5 kg of air expand adiabatically in closed system from 6 bar at 90° C to 1 bar at 40° C. calculate (i) maximum work, (ii) change of availability, (iii) irreversibility

Q-5 **Attempt all questions** **(14)**

a) A heat engine is operated between 700° C and 30° C. it drives a heat pump which works between 100° C and 30°C. Efficiency and COP of the heat engine and the heat pump are half of that of corresponding Carnot values. Calculate amount of heat rejected by heat pump at 100°C when 100KJ is absorbed by heat engine at 700°C.

b) Derive an expression for availability of steady flow open system.

Q-6 **Attempt all questions** **(14)**

a) Derive an expression for the mean effective pressure of Otto Cycle.

b) Determine of min air required per Kg of Solid or Liquid for complete combustion.

Q-7 **Attempt all questions** **(14)**

a) Explain Construction and working of Bomb calorimeter with neat sketch.

b) State and Explain Dalton's law of Partial pressures.

Q-8 **Attempt all questions** **(14)**

a) Write the limitation of the first law of thermodynamics with example.

b) In an air standard Otto cycle the maximum and minimum temperatures are 1600°C and 20°C. the heat supplied per kg of air is 900 KJ. Determine the compression ratio, the cycle efficiency and the ratio of maximum to minimum pressure in the cycle. Take Cv = 0.718 Kj/kg K and $\gamma = 1.4$