

Enrollment No: _____

Exam Seat No: _____

C.U.SHAH UNIVERSITY

Summer Examination-2017

Subject Name: Thermodynamics

Subject Code: 4TE04TDY1

Branch: B.Tech (Automobile)

Semester: 4

Date: 17/05/2017

Time: 02:00 To 05:00

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) Zeroth law of thermodynamics deals with.....
(A) Conservation of energy (B) Conservation of Mass
(C) Entropy (D) Thermal Equilibrium
- b) A system has single phase is called
(A) Isolated (B) Closed (C) Homogeneous (D) Heterogeneous
- c) If all the variables of a stream are independent of time it is said to be in
(A) Steady flow (B) Unsteady flow (C) Constant flow (D) Uniform flow
- d) Steady flow energy equation of throttling process for ideal gas
(A) $h_1 = h_2$ (B) $T_1 = T_2$ (C) $u_1 = u_2$ (D) None of the above
- e) The second law of thermodynamics defines
(A) Enthalpy (B) Internal Energy (C) Entropy (D) Heat
- f) For a reversible adiabatic process the change in entropy is
(A) Zero (B) Positive (C) Negative (D) Unity
- g) The ratio of actual useful work to maximum useful work called
(A) Efficiency (B) COP (C) Effectiveness (D) None of the above
- h) Throttling is constant Process.
(A) Temperature (B) Enthalpy (C) Entropy (D) Pressure
- i) Rankin cycle efficiency of a good steam power plant may be in the range of
(A) 10 – 15% (B) 15 - 20% (C) 35 – 45% (D) 70 – 80%
- j) The Rankin cycle as compared to Carnot cycle has..... work ratio
(A) Same (B) Low (C) High (D) All of the above
- k) In the Orsat apparatus pyrogallic acid solution is used to absorb
(A) CO₂ (B) O₂ (C) N₂ (D) CO
- l) Adiabatic flame temperature is maximum when air – fuel mixture is
(A) Stoichiometric (B) Rich (C) Lean (D) All of the above
- m) In an ideal gas the partial pressure of a component is
- n) Write the statement of Avogadro's Law

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

Q-2 Attempt all questions (14)

- a) Explain quasi-static process with PV diagram.
- b) Derive steady flow energy equation for the nozzle.



- Q-3** **Attempt all questions** (14)
- a) A cylinder contains 0.45m^3 of gas at $1 \times 10^5 \text{ N/m}^2$ and 800°C . The gas is compressed to volume of 0.12m^3 . The final pressure being $5 \times 10^5 \text{ N/m}^2$. Assume $\gamma = 1.4$, $R = 294.2 \text{ J/kg } ^\circ\text{C}$. Calculate mass of gas index of compression, increase in internal energy of gas, heat rejected by gas during compression.
- b) What is critical point? State the value of pressure and temperature at critical point of water.
- Q-4** **Attempt all questions** (14)
- a) Derive equation for maximum work obtainable from a finite body and thermal energy reservoir.
- b) Steam expand adiabatically in steam turbine from pressure 30 bar at 330°C to 5 bar, 205°C . Assume atm. Temperature 25°C , neglect change of KE and PE. Calculate (i) maximum useful work, (ii) change of availability, (iii) irreversibility and (iv) Effectiveness of the process.
- 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 irreversibility of closed system (Non flow Process).
- Q-6** **Attempt all questions** (14)
- a) Derive an expression for the efficiency of Carnot 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) An engine working on diesel cycle has max pressure and temperature of 45 bar and 1500°C . Pressure and temperature at the beginning of compression are 1 bar and 27°C . Determine the air standard efficiency of cycle. Take $\gamma = 1.4$ for air.
- Q-8** **Attempt all questions** (14)
- a) State and explain Gibbs-Dalton law.
- b) Write the short note on Vander Waals equation.

