

# C.U.SHAH UNIVERSITY

## Winter Examination-2015

**Subject Name:** Thermodynamics

**Subject Code:** 4TE03TDY1

**Branch:** B.Tech (Mechanical)

**Semester:** 3

**Date:** 08/12/2015

**Time:** 2:30 To 5:30

**Marks:** 70 marks

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.
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**Q-1**

**Attempt the following questions:**

**(14)**

- a) A definite area or space where some thermodynamic process takes place is known as.....  
A) Thermodynamic path B) thermodynamic Process  
C) thermodynamic cycle D) Thermodynamic system
- b) Which is extensive property of system.....  
A) volume B) temperature C) density D) pressure
- c) First law of thermodynamics deals with conservation of .....  
A) heat B) momentum C) work D) energy
- d) Kelvin-Planck's statement deals with conservation of.....  
A) heat into work B) work into heat C) heat D) work
- e) Second law of thermodynamics defines.....  
A) heat B) work C) internal energy D) entropy
- f) .....of system become maximum when its state is brought to state of surrounding.  
A) Internal energy B) Unavailable energy C) Available energy D) All of above.
- g) A cycle consist of two isothermal and two isentropic processes is known as ..... cycle. A) Carnot B) Stirling C) Ericsson D) Joule
- h) Otto cycle is known as constant .....cycle.  
A) pressure B) volume C) pressure-volume D) volume - temperature
- i) The ideal cycle on which a steam turbine works is ..... cycle.  
A) Carnot B) joule C) Brayton D) Rankine
- j) An equation of state is an equation relating the ..... of a substance.  
A) Pressure B) Temperature C) Specific volume D) All of above.
- k) Zeroth law of thermodynamics deals with..... A) conservation of temperature  
B) conservation of energy C) Thermal equilibrium D) none of above.
- l) Heat is .....function. A) point B) path C) cyclic D) all
- m) During combustion ..... always remains inert.  
A) nitrogen B) hydrogen C) oxygen D) hard carbon
- n) The bomb calorimeter is used for finding the ..... calorific value of solid and liquid fuels. A) lower B) medium C) higher D) any



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

- Q-2 Attempt all questions**
- A) State and write the 1st Law of thermodynamics for a thermodynamic process and also explain perpetual motion machine of first kind. (7)
  - B) Derive general steady flow energy equation with neat sketch. (7)
- Q-3 Attempt all questions**
- A) A turbine working under steady flow conditions and receives steam at a velocity of 50 m/s and elevation of 3 m and a specific enthalpy of 3000 KJ/kg. The steam leaves the turbine at a velocity of 80 m/s, an elevation of 1 m and a specific enthalpy of 2000 kJ/kg. Heat losses from the turbine to the surroundings amount to 1.5 kJ/hr. Determine the mass flow rate of steam required in kg/hr for output power of 375 kW. (7)
  - B) Explain Clausius inequality for reversible and irreversible cyclic processes. (7)
- Q-4 Attempt all questions**
- A) A Carnot engine receives 3500 KJ as heat addition at 300 °C and rejects energy at triple point of water. Calculate (1) thermal efficiency (2) The net work output in KJ. If the efficiency of an irreversible engine is 60 % of Carnot engine. Find the % change in heat rejected for the same input and fluid temperature. (7)
  - B) Explain the concept of available energy, unavailable energy. (7)
- Q-5 Attempt all questions**
- A) Draw the Diesel cycle on P-V and T-S diagram. Also derive expression for air standard efficiency with usual notations for the cycle. (7)
  - B) An air standard Otto cycle has a compression ratio of 9. At the start of the compression process, the temperature is 300 °K and the pressure is 1bar. If the maximum temperature of the cycle is 1080 °C calculate, (1) Heat supplied per kg of air. (2) The thermal efficiency of the cycle. (7)  
Take  $C_v = 0.718 \text{ kJ/kg.K}$  and  $\gamma = 1.4$ .
- Q-6 Attempt all questions**
- A) Draw and explain the schematic for an ideal Rankine cycle and represent on P-V, T-S, H-S diagram. (7)
  - B) A steam turbine of a power plant working on ideal Rankine cycle gets steam at 20 bar, 300 °C at the rate of 4 Kg/s and it leaves at 0.1 bar. Determine the following (a) Net power output (b) Rankine cycle efficiency (7)
- Q-7 Attempt all questions**
- A) Explain Enthalpy of formation and Enthalpy of reaction. (7)
  - B) Explain in brief how calorific value is determined by Junkers gas calorimeter. (7)
- Q-8 Attempt all questions**
- A) Explain: Avogadro's law. (3)
  - B) State and explain Gibbs-Dalton law. (4)
  - C) Prove that violation of Kelvin-Planck statement leads to violation of Clausius statement. (7)

