

C.U.SHAH UNIVERSITY

Winter Examination-2019

Subject Name : Thermodynamics**Subject Code: 4TE03TDY1****Branch: B.Tech (Mechanical)****Semester : 3****Date : 20/11/2019****Time : 02:30 To 05:30****Marks : 70**

Instructions:

- (1) Question 1 is compulsory.
- (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)**
- 1) The value of ratio of the steam point temperature to the ice point temperature is? **1**
 - a) 1.466
 - b) 1.266
 - c) 1.166
 - d) 1.366
 - 2) Celsius temperature of the triple point of water is (in degree Celsius)? **2**
 - a) -0.00
 - b) 0.00
 - c) 0.01
 - d) None of the mentioned
 - 3) Which of the following is chosen as the standard thermometric substance? **1**
 - a) Gas
 - b) Liquid
 - c) Solid
 - d) All of the mentioned
 - 4) Work done on a system is taken to be **1**
 - a) positive
 - b) negative
 - c) zero
 - d) varies according to situation
 - 5) The main constituents of a fuel are _____ **1**
 - a) Carbon and Oxygen b) carbon and hydrogen
 - c) hydrogen and oxygen d) sulphur and hydrogen
 - 6) The calorific value of gaseous fuel is given by unit _ **1**
 - a) kJ/kg b) kJ/m³ c) kJ/mol d) kJ/K
 - 7) The molecular mass of nitrogen is **1**
 - a) 24 b) 23 c) 27 d) 28
 - 8) Efficiency of Diesel cycle depends upon **1**
 - a) compression ratio b) cut-off ratio c) index γ d) all of the these
 - 9) A Carnot cycle consists of **1**
 - a) 2 adiabatics and 2 constant volume
 - b) 2 adiabatics and 2 isothermals
 - c) 2 isothermals and 2 constant volume
 - d) 2 constant volume and 2 constant pressure



- 10) Air standard efficiency of Otto cycle is given by 1
- a) $1 - \frac{1}{r^\gamma}$ b) $1 - \frac{1}{r^{\gamma+1}}$ c) $1 - \frac{1}{r^{\gamma-1}}$ d) $1 + \frac{1}{r^{\gamma-1}}$
- 11) When water is heated, the availability of water is 1
- a) decrease b) increase c) does not change d) not affected
- 12) Throttling is a constant _____ process. 1
- a) temperature b) enthalpy c) entropy d) pressure
- 13) COP is
- a) Co-efficient of expansion b) Co-efficient of pressure
- c) Co-efficient of performance d) Co-efficient of pump
- 14) For reversible process, net entropy is
- a) Zero b) positive c) negative d) none of these

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

- Q-2** Discuss in detail the reversible and Irreversible process. 14
- Q-3** (a) Discuss the equivalence of Kelvin-Plank and Clausius statements. 7
- (b) Prove the following equation for the thermodynamic cycle of Heat pumps and refrigerators. 7
- $(COP)_{HP} = (COP)_R + 1$
- Q-4** (a) Air at a temperature of 15° C passes through a heat exchanger at a velocity of 30 m/s where it is heated to 800° C. It then enters a turbine with the same velocity of 30 m/s and expands until the temperature falls of 650° C. On leaving the turbine the air is taken at velocity 60 m/s to nozzle where it expands until the temperature has fallen to 500° C. If the air flow rate is 2 kg/s. Calculate 7
- (a) Rate of heat transfer to the air in the heat exchanger
- (b) Power output from the turbine.
- (c) The velocity of air at exit of nozzle.
- Assume that no heat loss in turbine and nozzle.
- (b) Explain the characteristics of Steady and Unsteady flow process with clear figure. 7
- Q-5** (a) Define the term “Quasi-static” process. Discuss the process stating examples. 7
- (b) Compare and differentiate the Microscopic and Macroscopic approach. 7
- Q-6** (a) For the non-flow process derive $I = T_0 (\Delta S)_{universe}$. 7
- (b) Draw the Carnot cycle schematically showing all the components. Discuss the Carnot Cycle on p-v and T-s diagram. 7
- Q-7** (a) Discuss with neat sketch Bomb calorimeter. 7
- (b) Derive an equation of state using the virial and the Beattie-Bridgeman methods. 7
- Q-8** (a) Explain the engineering applications of steady state energy equation in nozzle. 7
- (b) Discuss the behavior of Pure substance with neat sketches. 7

