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

PARUL UNIVERSITY
FACULTY OF ENGINEERING & TECHNOLOGY
B.Tech. Summer 2018 - 19 Examination

Semester: 3 **Date: 27/05/2019**
Subject Code: 03109201 **Time: 02:00pm to 04:30pm**
Subject Name: Engineering Thermodynamics **Total Marks: 60**

Instructions:
1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Make suitable assumptions wherever necessary.
4. Start new question on new page.

Q.1 Answer the following short questions, filling the blanks and multiple choice questions **(15)**

1. Product of mass and specific heat of a substance is termed as _____.
2. When a solid substance is converted to gaseous form, the process is called _____.
3. Volume is an _____ property.
4. Heat transfer is a _____ function.
5. Helmholtz function F_____.
6. What is a pure substance
7. Show that the COP of heat pump is greater than the COP of refrigerator by unity.
8. Write down Van der wall's equation of state.
9. Explain concept of available Energy and unavailable Energy.
10. Explain concept of Quasi-static process.
11. A process, in which the temperature of the working substance remains constant during its expansion or compression, is called.
   A) isothermal process
   B) hyperbolic process
   C) adiabatic process
   D) polytropic process
12. For a reversible adiabatic process, change in entropy is……..
(a) zero (b)maximum (c)minimum (d)unity
13)second law of thermodynamics forms the basis of …….measurement
(a) Pressure (b) Temperature(c) Entropy (d) Work.
14. The entropy of water at 0°C is assumed to be
(a) 1 (b) 0 (c) -1 (d) 2
15)Which of the following is not a property of the system
(a)Temperature (b)Pressure(c) Specific volume (d)Heat

Q.2 Answer the following questions. (Attempt any three) **(15)**

A) 80 kg of water at 100°C are mixed with 50 kg of water at 60°C, while the temperature of the surroundings is 15°C. Determine the decrease in available energy due to mixing.

B) What are the Maxwell's relations.

C) Write steady flow energy equation in case of boiler and turbine.

D) Differentiate between Intensive and Extensive properties of system.

Q.3 A) A heat engine receives reversibly 420 kJ/cycle of heat from a source at 327°C, and rejects heat reversibly to a sink at 27°C. There are no other heat transfers. For each of the three hypothetical amounts of heat rejected, in (a), (b), and (c) below, compute the cyclic integral of dQ /T. From these results show that which case is irreversible, which case is reversible, and which case is impossible: **(07)**

(a) 210 kJ/cycle rejected

(b) 105 kJ/cycle rejected

(c) 315 kJ/cycle rejected

B) Prove the equivalency of Kelvin-Plank and Clausius statements.. **(08)**

OR

B) Derive both Tds Equations. **(08)**

Q.4 A) A heat pump working on the Carnot cycle takes heat from a reservoir at 5°C and delivers heat to a reservoir at 60°C. The heat pump is driven by a reversible heat engine which takes heat from a reservoir at 840°C and rejects heat to a reservoir at 60°C. The reversible heat engine also drives a machine that absorbs 30 kW. If the heat pump extracts 17 kJ/s from the 5°C reservoir, determine (a) The rate of heat supply from the 840°C source (b) The rate of heat rejection to the 60°C sink.. **(07)**

OR

A) A nozzle is a device for increasing the velocity of a steadily flowing stream. At the inlet to a certain nozzle, the enthalpy of the fluid passing is 3000 kJ/kg and the velocity is 60 m/s. At the discharge end, the enthalpy is 2762 kJ/kg. The nozzle is horizontal and there is negligible heat loss from it. (a) Find the velocity at exist from the nozzle. (b) If the inlet area is 0.1 m^2 and the specific volume at inlet is 0.187 m^3/kg, find the mass flow rate. (c) If the specific volume at the nozzle exit is 0.498 m^3/kg, find the exit area of the nozzle. **(07)**

B) 2 kg of water at 80°C are mixed adiabatically with 3 kg of water at 30°C in a constant pressure process of 1 atmosphere. Find the increase in the entropy of the total mass of water due to the mixing process (Cp of water = 4.187 kJ/kg K). **(08)**