**AKGEC/IAP/FM/02**

**AJAY KUMAR GARG ENGINEERING COLLEGE, GHAZIABAD**

**DEPARTMENT OF MECHANICAL ENGINEERING**

**SESSIONAL TEST-2**

Course: B.Tech Semester: IIIrd

Session: 2017-18 Section: ME- 1,2,3

Subject: Thermodynamics Sub. Code: RME-302

Max Marks: 50 Time: 2 hours

***Note***: Answer **all** the Sections.

**Section – A**

A. Attempt **all** the parts. (5 × 2 = 10)

* 1. Why does free expansion has zero work transfer?
  2. Define Availability.
  3. Is an isentropic process a reversible adiabatic process?
  4. Why entropy generation a path function?
  5. Derive the relation between (COP)ref and (COP)hp.

**Section - B**

1. Attempt **all** the parts. (5 × 5 = 25)
2. Prove that the maximum work obtainable from a heat engine operating between two reservoirs at temperature T1 and T2 is given by:

Wmax = m Cp [T11/2-T21/2]2

1. Two kg of water at 800C are mixed adiabatically with 3 kg of water at 300C 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)
2. A household refrigerator is maintained at a temperature of 20C every time the door is opened, warm material is placed inside, introducing an average of 420 kJ, but making a small change in the temperature of the refrigerator. The door is opened 20 times a day and the refrigerator operates at 15% of the ideal COP. The cost of work is Rs 2.50 per kWh. What is the monthly bill for this refrigerator? The atmosphere is at 300C.
3. A turbine operates under steady flow conditions, receiving steam at the following state: pressure1.2 MPa, temperature 1880C, enthalpy 2785 kJ/kg, velocity 33.3 m/s and elevation 3m. The steam leaves the turbine at the following state: pressure 20 kPa, enthalpy 2512 kJ/kg, velocity 100 m/s, and elevation 0 m. Heat is lost to the surroundings at the rate of 0.29 kJ/s. If the rate of steam flow through the turbine is 0.42 kg/s, what is the power output of the turbine in kW?
4. State the kelvin Planck and Clausius statement of 2nd law of thermodynamics. Show the equivalence of kelvin Planck and Clausius statement of 2nd law of thermodynamics?

**Section - C**

C. Attempt all the parts. (2 × 7.5 = 15)

1. Show that entropy is a property of a system. Water is heated at a constant pressure of 0.7 MPa. The boiling point is 164.970C. The initial temperature of water is 00C. The latent heat of vaporization is 2066.3 kJ/kg. Find the increase of entropy of water, if the final state is steam.
2. What do you understand by internal irreversibility and external irreversibility? Find the irreversibility associated with the expansion of air through a very small opening in a pipe from a pressure and temperature of 8 bar and 600 K to a pressure of 1.2 bar. Assume air to be an ideal gas and take temperature of surrounding as 298 K.