SECTION - C

Attempt **any two** quenstion from this section. (15×2=30)

10. Define thermal efficiency, mechanical efficiency, volumetric efficiency, Brake power, Indicated power of an IC engine and Explain the working of two stroke SI engine with sketch and differentiate between two stroke and four stroke SI engine.

11. Derive an expression for maximum work output possible from a heat engine operating between two reservoirs at T_1 and T_2. The heat source is formed by a body of mass m and specific heat C. A block of iron weighing 100 kg and having a temperature of 100°C is immersed in 50 kg of water at a temperature of 20 °C. What will be the change of entropy of the combined system of iron and water? Specific heats of iron and water are 0.45 and 4.18 kJ/kg K respectively.

12. Show Rankine cycle on P-V, T-S and H-S plane. Describe any one method of drynesss fraction measurement. In a steam power plant of 10 MW capacity, steam at 88 bar and 480°C expands isentropically in a turbine. If the condenser pressure is 0.04 bar, find heat added in the boiler.

—x—

(Following Paper ID and Roll No. to be filled in your Answer Book)

Paper ID : 140311 Roll No. | | | | | | | | | | |

B.Tech.

(SEM. III) THEORY EXAMINATION, 2015-16
THERMODYNAMICS

[Time : 3 hours] **[Total Marks : 100]**

SECTION - A

1. Attempt **all parts**. All parts carry **equal** mark. Write answer of each parts in short. (2×10=20)

   (a) What is critical point and triple point ?

   (b) What is concept of continuum ?

   (c) Discuss the significance of Clausius inequality.

   (d) State two limitations of First Law of thermodynamics.

   (e) Why does free expansion has zero work transfer ?

   (f) State Zeroth Law of thermodynamics.

   (g) Draw P-T diagram of pure substance.

   (h) A refrigerator has food article with its door closed. In one hour, the internal energy of food articles decreases by 4000kJ while the refrigerator consumed 1.2kWh of electrical energy. Find the net heat transfer during the process.

(i) What are the causes of irreversibility of a process?

(j) Define point function and path function. Indicate to which function the following cases belong to

(i) Internal Energy (iii) Work

(ii) Pressure (iv) Heat

SECTION - B

Attempt **any five** questions from this section. (10×5=50)

2. A system comprising of a gas of 5kg mass undergoes expansion process from 1MPa and 0.5m^3 to 0.5 MPa. Expansion process is governed by $pv^{1.3}$ = constant. The internal energy of the gas is given by, u = 1.8pv + 85 kJ/kg, u is the specific internal energy, p is the pressure in kPa, v is the specific volume in m^3/kg. Sketch the P-V diagram for the process. Determine heat and work interaction and change in internal energy.

3. Establish the equivalence of Kelvin Planck & Clausius Statement. Show that efficiency of a reversible heat engine operating between the same temperature limits is same.

4. A Carnot engine operating between temperatires T_1 & T_2 with efficiency η_1 and other Carnot engine operates between temperatures T_2 and T_3 with efficiency η_2. Show that the Carnot engine operating between temperatures T_1 & T_3 will have efficiency $(\eta_1+\eta_2-\eta_1\eta_2)$

5. Define irreversibility of the system. Derive an expression for irreversibility of a closed system.

6. Define Clausius Inequality. Prove that entropy of an isolated system always increases.

7. 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 3000kJ/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 exists 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 rat.

   (c) If the specific volume at the nozzle exit is 0.498 m^3/kg, find exit area of the nozzle.

8. What is steady flow process? Write the steady flow energy equation for single stream entering and single stream leaving a control volume. Show that enthalpy of fluid before throttling is equal to that after throttling.

9. A system composed of 2 kg of the above fluid expands in a frictionless piston and cylinder machine from an intial state of 1mPa, 100°C to a final temperature of 30 °C. If there is no heat transfer find the net work for the process.