**YMCA UNIVERSITY OF SCIENCE & TECHNOLOGY, FARIDABAD**

**B. TECH. 3RD SEMESTER (UNDER CBS)**

**THERMODYNAMICS (MU-207)**

**Time: 3 Hours** **Max. Marks: 60**

*Note:*
1. *It is compulsory to answer the questions of Part -A. Limit your answers within 20-40 word in this part.*
2. *Answer any four questions from Part -B in detail.*
3. *Different parts of the same question are to be attempted adjacent to each other.*
4. *Use of unmarked Steam tables, Mollier charts etc. is allowed.*
5. *Assume suitable standard data wherever required, if not given.*

## PART -A

Q1 (a) Give two examples of the intrinsic and extrinsic properties each? (2)

(b) List any two differences in work and heat. (2)

(c) What do you mean by Thermal Reservoir? (2)

(d) Show isothermal process on P-V and T-s plot. (2)

(e) Write the simplified steady flow energy equation for a nozzle. (2)

(f) Write the name of two calorimeters. What are these used for? (2)

(g) What is Dalton's law of partial pressure? (2)

(h) What do you mean by Unavailable energy? (2)

(i) Differentiate between Saturated and Superheat Steam. (2)

(j) Show triple point of water on schematic p-T diagram. (2)

## PART -B

Q2 (a) Discuss thermodynamic equilibrium. How is it different from thermal equilibrium? (5)

(b) Explain quasi-static process with the help of neat illustration. (5)

Q3 (a) A piston–cylinder device initially contains 0.07 $m^3$ of nitrogen gas at 130 kPa and 120°C. The nitrogen is now expanded isentropically to a pressure of 100 kPa. Determine the final temperature and the boundary work done during this process. (5)

(b) Air enters an adiabatic nozzle steadily at 300 kPa, 200°C, and 30 m/s and leaves at 100 kPa and 180 m/s. The inlet area of the nozzle is 80 $cm^2$. Determine (a) the mass flow rate through the nozzle, (b) the exit temperature of the air. (5)

Q4 (a) Prove the equivalency of both the second law statements. (5)

(b) Which is more effective way to increase the efficiency of a Carnot engine: to increase the source temperature, keeping sink temperature constant or to decrease the sink temperature, keeping source temperature constant. Explain. (5)

Q5 Discuss Clausius' theorem and prove that cyclic integral of $dQ/T$ for a reversible process is equal to zero. (10)

Q6 (a) Two kg of water at 50°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 ($c_p$ of water = 4.187 kJ/kg K). (5)

(b) Deduce the expression for available energy from a finite energy source at temperature T when the environmental temperature is $T_0$. (5)

Q7 (a) Ten kg of water at 45°C is heated at a constant pressure of 10 bar until it becomes superheated vapour at 300°C. Find the changes in volume, enthalpy, internal energy and entropy. (5)

(b) Show that for an ideal gas the internal energy depends only on its temperature. (5)

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