

**B. Tech ME (Semester – 3rd)**  
**THERMODYNAMICS**  
**Subject Code: BMECS1303**  
**Paper ID: [18112313]**

**Time: 03 Hours** **Maximum Marks: 60**

**Instruction for candidates:**

1. Section A is compulsory. It consists of 10 parts of two marks each.
2. Section B consist of 5 questions of 5 marks each. The student has to attempt any 4 questions out of it.
3. Section C consist of 3 questions of 10 marks each. The student has to attempt any 2 questions.

**Section – A** **(2 marks each)**

Q1. Attempt the following:

- a) Define the quasi static process.
- b) What do you mean by intensive and extensive properties?
- c) How does a homogeneous system differ from a heterogeneous system?
- d) Define the refrigeration effect and how it can be improved?
- e) What do you mean by non-flow process and flow process?
- f) What do you mean by throttling process?
- g) Define coefficient of performance.
- h) State Dalton's law of partial pressure.
- i). State third law of thermodynamics.
- j) Define entropy.

**Section – B** **(5 marks each)**

- Q2. Write the limitations of first law of thermodynamics.
- Q3. When a stationary mass of gas was compressed without friction at constant pressure its initial state of  $0.4 \text{ m}^3$  and  $0.105 \text{ MPa}$  was found to change to final state of  $0.20 \text{ m}^3$  and  $0.105 \text{ MPa}$ . There was a transfer of  $42.5 \text{ kJ}$  of heat from the gas during the process. How much did the internal energy of the gas change?
- Q4. Explain different processes of Brayton Cycle.
- Q5. What do you mean by Clausius theorem? Also state the inequality of Clausius?
- Q6. 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  $3000 \text{ kJ/kg}$  and the velocity is  $60 \text{ m/s}$ . At the discharge end, the enthalpy is  $2762 \text{ kJ/kg}$ . The nozzle is horizontal and there is negligible heat loss from it.
  - a. Find the velocity at exits from the nozzle.
  - b. If the inlet area is  $0.1 \text{ m}^2$  and the specific volume at inlet is  $0.187 \text{ m}^3/\text{kg}$ , find the mass flow rate.

**Section – C****(10 marks each)**

Q7. A heat pump working on the Carnot cycle takes in 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 in 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.

- The rate of heat supply from the 840 °C source
- The rate of heat rejection to the 60 °C sink.

Q8. Explain with Neat Sketch the working of Steam Power Plant. Also show the Reheat and Regenerative Rankine cycle on P-v and T-s diagram.

Q9. A fluid system, contained in a piston and cylinder machine, passes through a complete cycle of four processes. The sum of all heat transferred during a cycle is – 340 kJ. The system completes 200 cycles per min. Complete the following table showing the method for each item, and compute the net rate of work output in kW.

Process	Q (kJ/min)	W (kJ/min)	$\Delta E$ (kJ/min)
1-2	0	4340	----
2-3	42000	0	----
3-4	-4200	----	-73200
4-1	----	----	----