Roll No……..….. **Total No. of Printed Pages: [02]**
Total No. of Questions: [09]

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 Dolton'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 m3 and 0.105 MPa was found to change to final state of 0.20 m3 and 0.105 MPa. There was a transfer of 42.5 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 kJ/kg and the velocity is 60 mis. 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 exits 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.

Section – C **(10 marks each)**

Q7. A heat pump working on the Carnot cycle takes in heat from a reservoir at 5℃ and delivers heat to a reservoir at 60 ℃. The heat pump is driven by a reversible heat engine which takes in heat from a reservoir at 840 ℃ and rejects heat to a reservoir at 60 ℃. The reversible heat engine also drives a machine that absorbs 30 kW. If the heat pump extracts 17 kJ/s from the 5 ℃ reservoir, determine.

i. The rate of heat supply from the 840 ℃ source

ii. The rate of heat rejection to the 60 ℃ 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)	ΔE (kJ/min)
1-2	0	4340	----
2-3	42000	0	----
3-4	-4200	----	-73200
4-1	-----	----	----