

Roll No.....

Total No. of Printed Pages: 2

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B. Tech. (Aerospace Engg.) (Semester: 3rd)

BASICS OF THERMODYNAMICS

Subject Code: BASES1303

Paper ID: [19113004]

Time: 3 Hours

Maximum Marks: 60

Instructions to candidates

- 1) Section-A is COMPULSORY and consist of TEN questions carrying TWO marks each.
- 2) Section-B consist of FIVE questions of FIVE marks each & student has to attempt any FOUR questions.
- 3) Section-C consist of THREE questions of TEN marks each & student has to attempt any TWO questions.
- 4) Use of admissible data tables is allowed.

Section-A

(02 marks each)

- Q1. (a) Define the Zeroth Law of Thermodynamics.
(b) State the conditions for a physical system to be in thermodynamic equilibrium.
(c) Define Compressibility Factor.
(d) Why the efficiency of Carnot Cycle is maximum?
(e) Define Perpetual motion machine of First Kind (PMM1).
(f) Define the Dalton's Law of Partial Pressures.
(g) Differentiate between point and path functions with examples.
(h) State the principle of increase of entropy.
(i) Define Dryness Fraction.
(j) Differentiate between triple point and critical point.

Section-B

(05 marks each)

- Q2. A stationary mass of gas is compressed without friction from an initial state of 0.3 m^3 and 0.105 MPa to a final state of 0.15 m^3 and 0.105 MPa , the pressure remaining constant during the process. There is a transfer of 37.6 kJ of heat from the gas during the process. How much does the internal energy of the gas change?
- Q3. (a) Differentiate between constant volume & constant pressure gas thermometers. (2.5)
(b) What is irreversibility? State its significance. (2.5)
- Q4. One kg of water at 273 K is brought into contact with a heat reservoir at 373 K . When the water has reached 373 K , find the entropy change of the water, of the heat reservoir, and of the universe, take the specific heat of water = 4.186 kJ/kg .
- Q5. Find the enthalpy and entropy of steam when the pressure is 2 MPa and the specific volume is $0.09 \text{ m}^3/\text{kg}$.
- Q6. State and explain the law of corresponding states with suitable illustrations.

Section-C

(10 marks each)

- Q7. (a) In a certain process, a vapor, while condensing at 420°C , transfers heat to water evaporating at 250°C . The resulting steam is used in a power cycle which rejects heat at 35°C . What is the fraction of the available energy is the heat transferred from the process vapor at 420°C that is lost due to the irreversible heat transfer at 250°C ? (5)
(b) Why cannot a throttling calorimeter measure the quality if the steam is very wet? How is the quality measured then? (5)

- Q8. (a) State and explain Van-der Waal's equation of state for real gases. State the reasons for its deviation from the ideal gas equation of state. (5)
- (b) In a steady flow apparatus, 135 kJ of work is done by each kg of fluid. The specific volume of the fluid, pressure, & velocity at the inlet are $0.37 \text{ m}^3/\text{kg}$, 600 kPa , & 16 m/s respectively. The inlet is 32 m above the floor, and the discharge pipe is at floor level. The discharge conditions are $0.62 \text{ m}^3/\text{kg}$, 100 kPa , & 270 m/s . The total heat loss between the inlet and discharge is 9 kJ/kg of fluid. In flowing through this apparatus, does the specific internal energy increase or decrease, and by how much? (5)
- Q9. (a) Explain the equivalence of Kelvin-Planck's Statement and Clausius' Statement of the second law of thermodynamics. (5)
- (b) Figure-1 below shows a piston and cylinder machine containing a fluid system has a stirring device in the cylinder. The piston is frictionless, and it is held down against the fluid due to the atmospheric pressure of 101.32 kPa . The stirring device is turned 10,000 revolutions with an average torque of 1.275 Nm against the fluid. Meanwhile the piston of 0.6 m diameter moves 0.8 m , find the Net Work transfer for the system. (5)

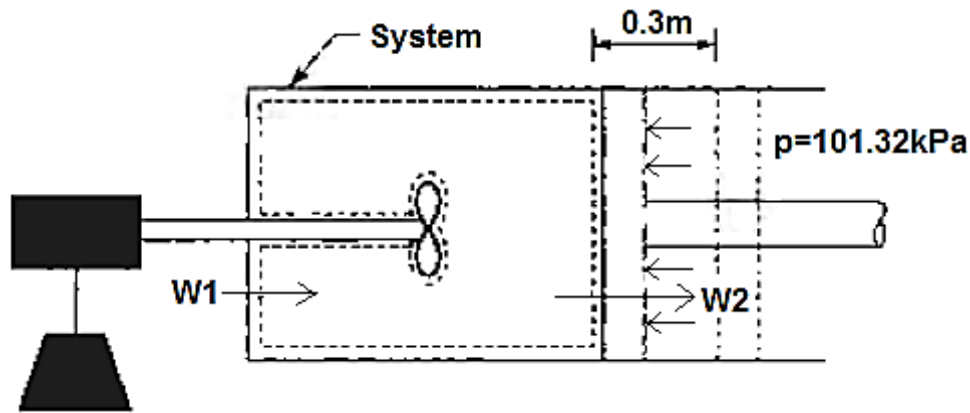


Figure-1