

**VIT**Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)Vellore – 632014, Tamil Nadu, India
SCHOOL OF MECHANICAL ENGINEERING
FALL SEMESTER 2023-2024**SLOT: D1+TD1****CONTINUOUS ASSESSMENT TEST – I**

Programme Name & Branch : B.Tech- Automotive, Mechanical, Manufacturing Engineering
Course Code : BMEE203L
Course Name : Engineering Thermodynamics
Class Number(s) : VL2023240101709, VL2023240101879, VL2023240101707,
VL2023240101706, VL2023240101708, VL20232401017
Faculty Members : Dr. Edison G, Dr. Porpatham E, Prof. P. Senthil Kumar,
Dr. M. Senthil Kumar, Dr. Immanuel Selwynraj A, Dr. Tapano
Kumar hotta
Date of Examination : 13 – 09 – 2023
Duration : 90 minutes Max. Marks: 5 x 10 = 50

General instruction(s): 1. Assume suitable data, if required,
2. Steam Tables and Compressibility chart are permitted

Answer ALL the Questions

Q. No	Question	Marks
1	a) Air in an automobile tubeless tire is initially at -10°C and 190 kPa. After the automobile is driven awhile, the temperature gets up to 10°C. Find the new pressure. You must make a suitable assumption. [2 Marks] b) When a car battery at 12 V is charged with 6 amp for 3 hours, how much energy is delivered? [2 Marks] c) Consider a TV set that consumes 120 W of electric power when it is on and is kept on for an average of 6 hours per day. When the electricity cost is 6 rupees per kWh, determine the cost of electricity this TV consumes per month (30 days). [2 Marks] d) Does heat transfer inevitably cause a temperature rise? Explain. [2 Marks] e) Which property of a system increases when heat is transferred: a) at constant volume, b) at constant pressure? [2 Marks]	10
2	A rigid closed tank of volume 3 m^3 contains 5 kg of wet steam at a pressure of 200 kPa. The tank is heated until the steam becomes dry saturated. Determine the final pressure and the heat transfer to the tank. Use steam table only.	10
3	Determine the specific volume of water vapor at 15 MPa and 350°C, using a) The ideal-gas equation [2 Marks] b) The generalized compressibility chart. [3 Marks] c) The steam tables. Also determine the error involved in the first two cases. [5 Marks]	10



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8

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4	A certain quantity of air initially at a pressure of 8 bar and 280°C has a volume of 0.035 m^3 . It undergoes the processes in the following sequence in a cycle: (a) Expands at constant pressure to 0.1 m^3 , (b) Follows polytropic process with $n = 1.4$, and (c) A constant temperature process (which completes the cycle). Show the processes on $P - V$ plot. Evaluate the net heat transfer in the cycle.	10
5	Air flows steadily at the rate of 0.4 kg/s through an air compressor, entering at 6 m/s with a pressure of 1 bar and a specific volume of $0.85 \text{ m}^3/\text{kg}$, and leaving at 4.5 m/s with a pressure of 6.9 bar and a specific volume of $0.16 \text{ m}^3/\text{kg}$. The internal energy of the air entering is 88 kJ/kg greater than that of the air entering. Cooling water in a jacket surrounding the cylinder absorbs heat from the air at the rate of 59 W . Calculate i) The power required to drive the compressor. ii) The inlet and outlet cross-sectional areas.	10