Code: 23ES1302

II B.Tech - I Semester – Regular / Supplementary Examinations
NOVEMBER 2025

THERMODYNAMICS
(MECHANICAL ENGINEERING)

Duration: 3 hours   Max. Marks: 70

Note: 1. This question paper contains two Parts A and B.
   2. Part-A contains 10 short answer questions. Each Question carries 2 Marks.
   3. Part-B contains 5 essay questions with an internal choice from each unit. Each Question carries 10 marks.
   4. All parts of Question paper must be answered in one place.

BL – Blooms Level   CO – Course Outcome

PART – A

		BL	CO
1.a)	Distinguish between macroscopic and microscopic viewpoints in thermodynamics.	L2	CO1
1.b)	Define intensive property and extensive property.	L1	CO1
1.c)	State the Zeroth Law of Thermodynamics.	L1	CO2
1.d)	Define enthalpy and write its mathematical expression.	L1	CO2
1.e)	Define entropy and state the principle of entropy increase.	L1	CO3
1.f)	State Carnot's principle.	L1	CO3
1.g)	Define dryness fraction and write its mathematical expression.	L1	CO4
1.h)	State the Clausius-Clapeyron equation.	L1	CO4
1.i)	List the four processes of Otto cycle.	L1	CO5

			BL	CO	Max. Marks
1.j)		Define sensible heat, latent heat, and sensible heat factor.	L1	CO5	

PART – B

			BL	CO	Max. Marks
UNIT-I					
2		Define and differentiate between open, closed, and isolated systems with examples.	L2	CO1	10 M
OR					
3		Explain the concept of thermodynamic equilibrium. Illustrate with suitable examples.	L2	CO1	10 M
UNIT-II					
4		Define and differentiate between point functions and path functions. Give examples of each and explain their significance in thermodynamic analysis.	L2	CO2	10 M
OR					
5		Derive the Steady Flow Energy Equation (SFEE) and explain its application to turbines, compressors, and nozzle.	L3	CO2	10 M
UNIT-III					
6		State the Kelvin-Planck and Clausius statements of the Second Law of Thermodynamics. Show their equivalence with a neat diagram.	L2	CO3	10 M
OR					

7	An insulated rigid vessel is divided into two chambers of equal volumes. One chamber contains air at 500 K and 2 MPa. The other chamber is evacuated. If the two chambers are connected d, what would be the entropy change?	L3	CO3	10 M

UNIT-IV

8	A vessel of volume 0.04 m^3 contains a mixture of saturated water and saturated steam at a temperature of 250°C. The mass of the liquid present is 9 kg. Find the pressure, the mass, the specific volume, the enthalpy, the entropy, and the internal energy.	L3	CO4	10 M

OR

9	Explain the construction and use of Mollier (h-s) chart for steam.	L2	CO4	10 M

UNIT-V

10	An engine of 250 mm bore and 375 mm stroke works on an Otto cycle. The clearance volume is 0.00263 m³. The initial pressure and temperature are 1 bar and 50°C. If the maximum pressure is limited to 25 bar, find the following: (i) The air standard efficiency of the cycle. (ii) The mean effective pressure for the cycle. For air : $\gamma = 1.4$, $C_v = 0.718$ kJ/kg K, $C_p = 1.005$ kJ/kg K	L3	CO5	10 M

	OR			
11	Explain the working of an air refrigeration system with a schematic and T-S diagram. Derive the expression for COP.	L3	CO5	10 M