

**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION)**

**CLASS: B.TECH
BRANCH: MECHANICAL ENGINEERING**

**SEMESTER : III
SESSION : MO/2025**

SUBJECT: ME24201-THERMODYNAMICS

TIME: 02 HOURS

FULL MARKS: 25

INSTRUCTIONS:

1. The question paper contains 5 questions each of 5 marks and total 25 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
4. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates

		CO	BL
Q.1(a) Thermodynamics can be studied by adopting either a macroscopic or a microscopic approach. Distinguish between macroscopic & microscopic approach with examples of properties involved in both the approaches.	[2]	1	2
Q.1(b) A balloon is filled with air (200 kpa/300k) such that it becomes a sphere of diameter 1 m. It is then gradually heated till its pressure rises to 500 kpa. Determine the amount of the work done during the process, assuming that the pressure inside the balloon is proportional to the diameter of the balloon	[3]	1	4
Q.2(a) What is a process? Explain the meaning of Quasi-static process and also state its characteristic features.	[2]	1	2
Q.2(b) An ideal gas is heated at constant volume until its temperature is 3 times the original temperature, then it is expanded isothermally till it reaches its original pressure. The gas is then cooled at constant pressure till it is restored to the original state. Determine the net work done per kg of gas if the initial temperature is 350k.	[3]	1	4
Q.3(a) What are point and path functions? Explain with illustration that both work and heat are path functions and not point functions.	[2]	1	2
Q.3(b) Show that the enthalpy of a fluid before throttling is equal to that after throttling [$h_i = h_e$]	[3]	2	2
Q.4(a) Define internal energy and specific heats of a system	[2]	2	2
Q.4(b) A gas of mass 1.5 kg undergoes a quasi-static expansion which follows a relationship $p = a + bV$, where a and b are constants. The initial and final pressures are 1000 kPa and 200 kPa respectively and the corresponding volumes are 0.20 m ³ and 1.2 m ³ . The specific internal energy of the gas is given by the relation $u = 1.5 pv - 85 \text{ kJ/kg}$ where p is in kPa and v is in m ³ /kg. Calculate the net heat transfer and the maximum internal energy of the gas attained during expansion.	[3]	2	4
Q.5(a) Derive an expression for work done in a polytropic process.	[2]	2	2
Q.5(b) Dry saturated steam at 5 bar enters an adiabatic nozzle at a velocity of 2m/s and leaves as dry saturated steam at 2 bar. calculate the exit velocity of the steam.	[3]	2	4

:::18/09/2025:::E