



K. K. Wagh Institute of Engineering Education & Research, Nashik
(An Autonomous Institute From A.Y. 2022-23)

| InSem Examination-II Summer 2025 | |
|----------------------------------|----------------------|
| Exam Seat No.: | |
| Academic Year: 2024-2025 | Semester: IV |
| Class: SY | Program: B.Tech |
| Branch Code: CHE | Pattern: 2023 |
| Name of Course: Thermodynamics | Course Code: 2307213 |
| Max. Marks: 30 | Duration: 1.15 Hrs. |

Instructions: Candidates should read carefully the instructions printed on the Question Paper and on the cover page of the Answer Book, which is provided for their use.

1. This question paper contains 02 page(s).
2. Answer to each new question is to be started on a new page.
3. Assume suitable data wherever required, but justify it.
4. Draw the neat labelled diagrams, wherever necessary.
5. The last columns indicates the Course Outcome of the Question/sub-question.

Marks CO

Question No. 1

- 1 a) Define a thermodynamic system and discuss the types of systems with examples. Explain the difference between reversible and irreversible process. (7) CO1

Question No. 2

- 2 a) Define heat capacity. Derive the expression for heat capacity at constant pressure and at constant volume. (8) CO1

OR

- 2 b) A gas is confined in a cylinder with a diameter of 0.15 m by a piston, on which a weight is resting. The mass of the piston and weight together is 80 kg. The acceleration due to gravity is 9.8 m/s^2 , and the atmospheric pressure is 100 kPa. (8) CO1

i. What is the force exerted on the gas by the atmosphere, the piston, and the weight, assuming no friction between the piston and cylinder?

ii. What is the pressure of the gas in the cylinder?

iii. If the gas in the cylinder is heated, it will expand and push the piston and weight upward. What is the work done by the gas if the piston and weight are raised 0.5 m?

iv. What is the change in the potential energy of the piston and the weight after the expansion of 0.5 m?

Question No. 3

- 3 a) Explain the physical significance of the triple point using PT diagram. (7) CO2

Question No. 4

- 4 a) Show that for adiabatic process, $PV^\gamma = \text{Constant}$. (8) CO2

OR

- 4 b) An ideal gas undergoes the following three processes in sequence. The gas is heated at constant volume, starting from 320 K and 1.5 bar, until its pressure increases to 3 bar. It then undergoes a

reversible adiabatic expansion until the pressure drops back to 1.5 bar. Finally, the gas is cooled at constant pressure of 1.5 bar until it returns to its initial temperature of 320 K. Determine the heat and work interactions for each stage. (Assume $C_p = 28 \text{ kJ/kmol}\cdot\text{K}$ and $\gamma = 1.4$).

..... **End of question paper**.....