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SCHOOL OF CHEMICAL ENGINEERING
CONTINUOUS ASSESSMENT TEST -I
FALL SEMESTER 2025-2026

SLOT: A1+TA1+TAA1

Programme Name & Branch	:	**B.Tech - Chemical**
Course Code	:	**BACHE101**
Course Name	:	**Chemical Engineering Thermodynamics - TH**
Faculty Name(s)	:	**L.Muruganandam**
Class Number(s)	:	**VL2025260107117**
Date of Examination	:	**17-08-2025**
Exam Duration	:	**90 minutes** **Maximum Marks: 50**

General instruction(s): Read carefully the statement and answer all Questions.

Q. No	Question	Marks
1.	(a) Explain the concept of a continuum in thermodynamics and its significance in analyzing thermodynamic systems. (3M) (b) Explain thermodynamic equilibrium state. (4M) (c) Define the first law of thermodynamics and describe its relevance in everyday life. (3M)	10
2.	(a) What is entropy? How it is related to enthalpy and Internal energy (4M). (b) Water at 250 kPa and 350 K (H = 383.3 kJ/kg) enters a straight horizontal pipe at a velocity 3 m/s where it is heated by flue gases from the outside. Steam leaves the system at 185 kPa and 513 K (H = 3276.3 kJ/kg) at a velocity of 195 m/s. How much heat must have been supplied per kg of water flowing? (6M)	10
3.	a) A 2.5 L sealed container holds an ideal gas at a pressure of 3 atm and a temperature of 27°C. The gas is then heated to 127°C. Assuming the volume remains constant, what's the new pressure inside the container? (5M) b) Derive the Maxwell relation from the fundamental equation for the Gibbs free energy, dG = VdP − SdT. Explain its significance in relating measurable thermodynamic properties to non-measurable ones. (5M)	10
4.	(a) Explain phase diagram of water with a neat diagram. (5M) (b) A mountaineer is attempting to cook food at an altitude where the atmospheric pressure is 0.6atm (456mm Hg). The vapor pressure data is related by the Antoine	10

equation:

$$log_{10}P = A - \frac{B}{C+T}$$

where P is in mmHg, T is in °C, and the coefficients are

A = 8.071, B = 1730.63, and C = 233.426. Calculate the boiling point of water at this altitude. Discuss the implications of this lower boiling point for cooking food.

(5M)

5. Calculate the change in internal energy (ΔU), enthalpy (ΔH), entropy (ΔS), and Gibbs free energy (ΔG) for one kilomole (kmol) of nitrogen gas (N_2) when it's heated and compressed from an initial state of 300 K and 1 bar to a final state of 400 K and 10 bar. The entropy of nitrogen in its initial state is 191.6 kJ/kmol K. Assume the enthalpy at 273 K is zero. Nitrogen can be treated as an ideal gas. 10

Assume the molar heat capacity at constant pressure (CP) is given by the equation: $C_P = 29.1 + 4.3 \times 10^{-3}T$ where C_P is in kJ/kmol K and T is in K.

(10M)

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