

GUJARAT TECHNOLOGICAL UNIVERSITY**BE- SEMESTER– III EXAMINATION – SUMMER 2026****Subject Code:3130507****Date:19-06-2026****Subject Name:Chemical Engineering Thermodynamics I****Time:02:30 PM TO 05:00 PM****Total Marks:70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

		MARKS
Q.1	(a) Define Thermodynamics, Thermodynamic system, and Thermodynamic Process.	03
	(b) State and explain phase rule for non-reacting system with examples.	04
	(c) Explain PVT behavior of pure substance with neat diagrams.	07
Q.2	(a) Differentiate between intensive and extensive properties with examples.	03
	(b) State various units of temperature and mention relations between them on various temperature scales.	04
	(c) Derive equation of constants of Vander Waal's equation of state in terms of critical constants of a substance.	07
	OR	
	(c) Derive Virial equation of states starting from fundamentals. Explain Virial coefficients and their significance.	07
Q.3	(a) State various statements of second law of thermodynamics.	03
	(b) Explain Hess's law of constant heat summation.	04
	(c) A steel casting [$C_p = 0.5 \text{ kJ kg}^{-1} \text{ K}^{-1}$] weighing 40 kg and at a temperature of 450°C is quenched in 150 kg of oil [$C_p = 2.5 \text{ kJ kg}^{-1} \text{ K}^{-1}$] at 25°C. If there are no heat losses, what is the change in entropy of (i) the casting (ii) the oil, and (iii) both considered together?	07
	OR	
Q.3	(a) Write a note on "Third law of thermodynamics"	03
	(b) Explain standard heat of formation and standard heat of reaction.	04
	(c) State and prove Carnot theorem for heat engines.	07
Q.4	(a) Explain sensible heat and latent heat.	03
	(b) Define heat capacity and explain its temperature dependency.	04
	(c) Derive Maxwell equations using fundamental property relations for a homogeneous fluid of constant composition.	07
	OR	
Q.4	(a) Explain temperature dependency of heat of reaction	03
	(b) Explain various thermodynamic diagrams in brief.	04
	(c) For the two-phase systems, Derive the Clausius / Clapeyron equation relating latent heat of vaporization directly to the vapor-pressure curve.	07
Q.5	(a) Define Mach number and explain its significance.	03
	(b) Explain flow of fluids through nozzles.	04
	(c) Explain COP of refrigeration and derive equation of COP for Carnot refrigeration cycle.	07
	OR	
Q.5	(a) Explain Throttling process in brief.	03
	(b) Write a note on ejectors.	04
	(c) Explain factors affecting the choice of refrigerant in detail.	07
