Register No : _____

THE KAVERY ENGINEERING COLLEGE

(An Autonomous Institution)

B.E/B.TECH DEGREE END SEMESTER THEORY EXAMINATIONS, NOV /DEC 2024

Fourth Semester

Chemical Engineering

CH3401 - Chemical Engineering Thermodynamics - I

Regulations - 2021

Duration : 3 Hrs *Maximum : 100 Marks*

*PART – A (ANSWER ALL QUESTIONS) (Marks 10*2=20)*

Q.No	*Questions*	*BLT*	*CO*	*Marks*
1.	Classify energy and recall the terms point and path functions.	UN	1	2
2.	Define Zeroth law of thermodynamics.	RE	1	2
3.	State first law of thermodynamics for flow and non-flow processes.	RE	2	2
4.	Write the compressibility factor correlation and its importance in thermodynamics.	UN	2	2
5.	Brief Carnot cycle.	UN	3	2
6.	Define entropy.	RE	3	2
7.	Relate Gibbs free energy and its significance in chemical engineering thermodynamics.	RE	4	2
8.	List the applications of Maxwell relations in thermodynamic property determination.	RE	4	2
9.	Differentiate compression and expansion processes.	UN	5	2
10.	Explain the working principles of a steam power plant from a thermodynamic perspective.	UN	5	2

*PART – B (ANSWER ALL QUESTIONS) (Marks 5*13 = 65)*

Q.No		*Questions*	*BLT*	*CO*	*Marks*
11.	a	Explain the zeroth law of thermodynamics and discuss how it leads to the establishment of temperature scales.	UN	1	13
		Or			
	b	Outline the characteristics of thermodynamic systems and processes with relevant examples.	UN	1	13
12.	a	Explain PVT behavior in fluids and how generalized equations of state are used to represent this behavior.	UN	2	13
		Or			
	b i	Define compressibility factor and explain its relevance for real gases.	UN	2	5
	ii	Calculate ΔU and ΔH for 1 kg of water when it is vaporized at the constant temperature of 100°C and the constant pressure of 101.33 kPa. The specific volumes of liquid and vapor water at these conditions are 0.00104 and 1.673 $m^3 \cdot kg-1$, respectively. For this change, heat in the amount of 2256.9 kJ is added to the water.	AP	2	8

13.	a	Describe Joule's experiment and its significance in understanding internal energy changes.	UN	3	13
		Or			
	b	Explain the second law of thermodynamics and its application in heat engines.	UN	3	13
14.	a	Explain the significance of Helmholtz and Gibbs free energies in thermodynamics.	UN	4	13
		Or			
	b	Write a note on residual properties and explain how they are used to account for real gas behavior.	UN	4	13
15.	a	Steam generated in a power plant at a pressure of 8600 kPa and a temperature of 500°C is fed to a turbine. Exhaust from the turbine enters a condenser at 10 kPa, where it is condensed to saturated liquid, which is then pumped to the boiler. (a) What is the thermal efficiency of a Rankine cycle operating at these conditions? (b) What is the thermal efficiency of a practical cycle operating at these conditions if the turbine efficiency and pump efficiency are both 0.75? (c) If the rating of the power cycle of part (b) is 80,000 kW, what is the steam rate and what are the heat-transfer rates in the boiler and condenser?	AP	5	13
		Or			
	b	Develop the relevance of thermodynamic cycles in power generation and refrigeration processes.	AP	5	13

*PART – C (Marks 1*15 = 15)*

Q.No		*Questions*	*BLT*	*CO*	*Marks*
16.	a	Explain the second law of thermodynamics and discuss its applications in evaluating the feasibility of thermodynamic systems.	UN	3	15
		Or			
	b	Interpret the Maxwell relations and discuss their use in deriving thermodynamic property relationships.	UN	4	15