Register No : _____

THE KAVERY ENGINEERING COLLEGE

(An Autonomous Institution)

UG/PG DEGREE END SEMESTER THEORY EXAMINATIONS, APRIL/MAY 2026

Third Semester

Mechanical Engineering

ME3391 – ENGINEERING THERMODYNAMICS

(Common to Fourth Semester Agricultural Engineering)

(Steam Table with Mollier Chart Can be Permitted)

Regulations - 2021

Duration : 3 Hrs *Maximum : 100 Marks*

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

Q.No	*Questions*	*BLT*	*CO*	*Marks*
1.	Define Zeroth law of Thermodynamics.	L1	1	2
2.	Differentiate Intensive and Extensive properties.	L2	1	2
3.	Relate the COP of a refrigerator & heat pump.	L1	2	2
4.	What do you mean by “Clausius inequality”?	L1	2	2
5.	Define Irreversibility.	L1	3	2
6.	What do you understand by the entropy principle?	L1	3	2
7.	Define dryness fraction.	L1	4	2
8.	Compare triple point and critical point.	L2	4	2
9.	Classify the application of Clausius - Clapeyron equation.	L2	5	2
10.	Define molar mass.	L1	5	2

*PART – B (ANSWER ALL QUESTIONS) (Marks 5*16 = 80)*

Q.No		*Questions*	*BLT*	*CO*	*Marks*
11.	a	A stationary fluid system goes through a cycle comprising the following processer: (a) Process 1-2 isochoric heat addition of 235 kJ/kg. (b) Process 2-3 adiabatic expansion to its original pressure with loss of 70kJ/kg in internal energy. (c) Process 3-1 isobaric compression to its original volume with heat rejection of 200 kJ/kg. Prepare a balance sheet of energy quantities and find the overall changes during the cycle.	L3	1	16
		Or			
	b	Air flows steadily at the rate of 0.5 kg/s through an air compressor, entering at 7 m/s velocity, 100 kPa pressure, and 0.95 m^3/kg volume, and leaving at 5 m/s. 700 kPa, and 0.19 m^3/kg. The internal energy of the air leaving is 90 kJ/kg greater than that of the air entering. Cooling water in the compressor jackets absorbs heat from the air at the rate of 58 kW. (a) Compute the rate of shaft work input to the air in kW. (b) Find the ratio of the inlet pipe diameter to outlet pipe diameter.	L3	1	16

12.	a	Two reversible heat engines A and B are arranged in series, A rejecting heat directly to B. Engine A receives 200 kJ at a temperature of 421°C from a hot source, while engine B is in communication with a cold sink at a temperature of 4.4°C. If the work output of A is twice that of B, find (a) the intermediate temperature between A and B. (b) the efficiency of each engine, and (c) the heat rejected to the cold sink.	L3	2	16
		Or			
	b	Two kg of water at 80°C are mixed adiabatically with 3 kg of water at 30°C in a constant pressure process of 1 atmosphere. Find the increase in the entropy of the total mass of water due to the mixing process (c_p of water = 4.187 kJ/kg K).	L3	2	16
13.	a	A system receives 10000 kJ of heat at 500 K from a source at 1000 K. The temperature of the surroundings is 300 K. Assuming that the temperature of the system and source remains constant during heat transfer, find: (i) The entropy production due to above mentioned heat transfer (ii) Decrease in available energy.	L3	3	16
		Or			
	b	1 kg of ice at 0°C is mixed with 12 kg of water at 27°C. Assuming the surrounding temperature as 15°C, calculate the net increase in entropy and unavailable energy when the system reaches common temperature.	L3	3	16
14.	a	Explain the process of steam generation (change of phase of water) at constant pressure. Show the various stages on p-v and T-s diagrams.	L2	4	16
		Or			
	b	A vessel having a capacity of 0.05 m³ contains a mixture of saturated water and saturated steam at a temperature of 245°C. The mass of the liquid present is 10 kg. Find the following: (i) The pressure and the mass (ii) The specific volume and the specific enthalpy (iii) The specific entropy and the specific internal energy	L2	4	16
15.	a	A vessel of 0.35 m³ capacity contains 0.4 kg of carbon monoxide (molecular weight = 28) and 1 kg of air at 20°C. Calculate: (1) The partial pressure of each constituent, (ii) The total pressure in the vessel. The gravimetric analysis of air may be taken as 23.3% oxygen (molecular weight = 32) and 76.7% nitrogen (molecular weight = 28).	L3	5	16
		Or			
	b	Derive Maxwell relations.	L3	5	16