Register No : _____

THE KAVERY ENGINEERING COLLEGE

(An Autonomous Institution)

B.E/B.TECH DEGREE END SEMESTER THEORY EXAMINATIONS, APRIL-MAY 2025

Fourth Semester

Agricultural Engineering

ME3391 – Engineering Thermodynamics

(Common to Third Semester Mechanical Engineering)

Use of Steam Tables is 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.	State Zeroth law of thermodynamics.	L1	1	2
2.	Differentiate between Point function and Path function.	L2	1	2
3.	Define Kelvin Planck Statement.	L1	2	2
4.	State Carnot theorem and its corollaries.	L1	2	2
5.	List the causes of irreversibility.	L2	3	2
6.	Write about principle of increase in entropy.	L2	3	2
7.	Using steam tables, determine the mean specific heat for superheated steam at 0.75 bar, between 100°C and 150°C.	L3	4	2
8.	Differentiate between dry steam and wet steam.	L2	4	2
9.	Compare ideal and perfect gas.	L2	5	2
10.	Define Compressibility Factor.	L1	5	2

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

Q.No		*Questions*	*BLT*	*CO*	*Marks*
11.	a	A cylinder contains 1m^3 of gas at 100 kpa and 100°C, the gas is polytropically compressed to a volume of 0.25 m^3. The final pressure is 100 kpa. Determine a. Mass of the gas b. The value of index 'n' for compression c. Change in internal energy of the gas d. Heat transferred by the gas during compression. Assume R = 0.287kJ/kg K; γ = 1.4.	L3	1	16
		Or			
	b	In an air compressor air flows steadily at the rate of 0.5 kg/s through an air compressor. It enters the compressor at 6 m/s with a pressure of 1 bar and a specific volume of 0.85 m^3/kg and leaves at 5 m/s with a pressure of 7 bar and a specific volume of 0.16 m^3/kg. The internal energy of the air leaving is 90 kJ/kg greater than that of the air entering. Cooling water in a jacket surrounding the cylinder absorbs heat from the air at the rate of 60 kJ/s. Calculate: (i) The power required to drive the compressor. (ii) The inlet and outlet pipe cross-sectional areas.	L3	1	16

12.	a	Two Carnot engines A and B are operated in series. The first one (A) receives heat at 870 K and rejects to a reservoir at temperature T. The second engine (B) receives the heat rejected by first engine and in turn rejects to a heat reservoir at 300 K. Calculate the temperature t in °C for the following cases (a) The work output of the two engines are equal and (b) The efficiencies of the two engines are equal.	L4	2	16
		Or			
	b	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 (c) The heat rejected to the cold sink.	L4	2	16
13.	a	One kg of water at 280 K is having contact with the reservoir at 380 K. a) When the water attains the temperature of 380 K, find the change in entropy of the water, of the reservoir and of the universe. b) If water is heated from 280 K to 380 K, by first bringing it in contact with reservoir at 330K and then with a reservoir at 380K, what will be the change in entropy of the universe? c) Explain how the water can be heated from 280 K to 380 K with no change in entropy of the universe.	L3	3	16
		Or			
	b	One kg of ice at -5^{o}C is exposed to the atmosphere which is at 20^{o}C. The ice melts and comes into thermal equilibrium with the atmosphere. i) Determine the entropy increase of the universe ii) What is the minimum amount of work necessary to convert the water back into ice at --5^{o}C? C_P of the ice is 2.093 KJ/kg k and the latent heat of fusion of ice is 333.3 KJ/ kg.	L3	3	16
14.	a	Evaluate the enthalpy, specific volume, internal energy and entropy of 1 kg of steam at a pressure of 10 bar when the condition of steam is a) wet and dryness fraction of 0.85 b) dry and saturated and c) at a temperature of 199^{0}C. The specific heat of superheated steam at constant pressure is 2.26 KJ/kg.	L3	4	16
		Or			
	b	A vessel of volume 0.04 m^3 contains a mixture of saturated water and saturated steam at a temperature of 250^{0}C. The liquid present is 9 kg. Find the following i) The pressure ii) The mass iii) the specific volume iv) the specific enthalpy v) the specific entropy vi) the specific internal energy.	L3	4	16
15.	a	Derive the Maxwell relations and explain their importance in thermodynamics.	L2	5	16
		Or			
	b	Derive generalized equation of Joule-Thomson co-efficient and prove that Joule-Thomson co-efficient for an ideal gas is zero.	L2	5	16