Register No : _____

THE KAVERY ENGINEERING COLLEGE

(An Autonomous Institution)

B.E/B.TECH DEGREE END SEMESTER THEORY EXAMINATIONS, APRIL/MAY 2026

Third Semester

Chemical Engineering

UCHT24301 / CH3301 - Basic Mechanical Engineering

Regulations – 2024 & 2021

Duration : 3 Hrs *Maximum : 100 Marks*

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

Q.No	*Questions*	*BTL*	*CO*	*Marks*
1.	Indicate the significance of Zeroth Law of Thermodynamics.	L2	1	2
2.	Identify the terms involved in steady flow energy equation.	L2	1	2
3.	Why is the Clausius statement important in the Second Law of Thermodynamics?	L2	2	2
4.	List the limitations of the First Law of Thermodynamics.	L2	2	2
5.	Mention the principle of a heat pump.	L1	3	2
6.	How does a polytropic process differ from isothermal and adiabatic processes?	L2	3	2
7.	Why throttling process is considered isenthalpic?	L2	4	2
8.	Identify the conditions under which Carnot cycle operates.	L2	4	2
9.	How is dryness fraction measured in steam?	L2	5	2
10.	Why is reaction turbine preferred over impulse turbine in certain applications?	L2	5	2

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

Q.No			*Questions*	*BLT*	*CO*	*Marks*
11.	a	i	Illustrate the Zeroth Law of Thermodynamics and its significance in temperature measurement. Explain how it is applied in thermocouples and thermometers, giving suitable examples.	L2	1	8
		ii	Two blocks, A at 100°C and B at 25°C, are brought into thermal contact. Using the Zeroth Law, determine the final equilibrium temperature and explain how this principle applies in industrial temperature measurement systems like thermocouples.	L4	1	8
			Or			
	b	i	Exemplify the concepts of heat engine, refrigerator, and heat pump. Using suitable diagrams, describe their working principles and applications in real life.	L2	1	8
		ii	A heat engine absorbs 500 kJ from a reservoir at 500 K and rejects heat to a reservoir at 300 K. Calculate the maximum possible work output using the Kelvin-Planck statement, and discuss why a real engine cannot achieve this ideal performance.	L4	1	8

12.	a		Derive expressions for work done, heat transfer, and change in internal energy for an isothermal and constant volume process of an ideal gas. Illustrate with numerical examples and explain how these processes differ in terms of energy transfer.	L3	2	16
			Or			
	b		Derive the work done and heat transfer expressions for an adiabatic and polytropic process. Compare the processes and discuss the conditions under which a polytropic process can approximate an adiabatic process.	L3	2	16
13.	a		Derive the expression for efficiency of the Otto cycle in terms of compression ratio and specific heat ratio (γ). Analyze how increasing compression ratio affects engine efficiency and discuss practical limitations such as engine knocking.	L4	3	16
			Or			
	b		Explain the dual combustion (mixed) cycle, derive its efficiency expression, and discuss its advantages over Otto and Diesel cycles. Include a P-V and T-s diagram and analyze how combination of constant volume and constant pressure heat addition improves performance.	L4	3	16
14.	a	i	Discuss the concepts of Brake Thermal Efficiency (BTE), Indicated Thermal Efficiency (ITE), and Specific Fuel Consumption (SFC). Explain how engine design, operating conditions, and fuel type affect these performance parameter.	L2	4	10
		ii	Compare four-stroke and two-stroke engines in terms of power output, efficiency, and practical applications.	L3	4	6
			Or			
	b	i	Explain the properties of steam, including dryness fraction, latent heat, total heat of wet steam, superheated steam, internal energy, and entropy. Discuss their importance in steam power plant performance.	L2	4	10
		ii	Compare impulse and reaction turbines in terms of principle of operation, energy conversion, blade design, degree of reaction, efficiency, and applications	L3	4	6
15.	a	i	Illustrate the types of belt and rope drives, including velocity ratio, slip, creep, and ratio of tensions.	L2	5	8
		ii	Explain the classification of kinematic links, pairs, and kinematic chains. Interpret their significance in mechanical system.	L2	5	8
			Or			
	b		Explain the balancing of rotating masses in the same plane and in different planes. Also explain the suitable methods to reduce vibrations in machinery with examples.	L2	5	16