Register No : _____

THE KAVERY ENGINEERING COLLEGE

(An Autonomous Institution)

B.E/B.TECH DEGREE END SEMESTER THEORY EXAMINATIONS, NOV/DEC 2025

Fourth Semester

Mechanical Engineering

ME3451 - Thermal Engineering

(Use of approved steam tables 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.	State the assumption made in analysis the air-standard cycles.	L1	1	2
2.	What are the factors that affect the efficiency of Rankine cycle?	L1	1	2
3.	Infer metastable flow.	L2	2	2
4.	Summarize the effect of super saturation in the nozzles.	L2	2	2
5.	State the principle of impulse and reaction turbine.	L2	3	2
6.	What is the effect of regeneration on the performance of open cycle gas turbine.	L1	3	2
7.	Infer the term 'detonation'.	L2	4	2
8.	Define delay period with respect to CI engine.	L1	4	2
9.	What is the purpose of a thermostat in engine Cooling system.	L2	5	2
10.	List the advantages of supercharging.	L1	5	2

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

Q.No		*Questions*	*BLT*	*CO*	*Marks*
11.	a	An engine of 250 mm bore and 375 mm stroke works on Otto cycle. The clearance volume is 0.00263 m^3. The initial pressure and temperature are 1 bar and 50 °C. If the maximum pressure is limited to 25 bar, determine the following: (i) Temperature and pressure at all salient points (ii) The air standard efficiency of the cycle (iii) The mean effective pressure for the cycle Assume the ideal conditions.	L3	1	16
		Or			
	b	A Rankine cycle operates between pressures of 80 bar and 0.1 bar. The maximum cycle temperature is 600 °C. If the steam turbine and condensate pump efficiencies are 0.9 and 0.8 respectively, determine the specific work and thermal efficiency.	L3	1	16
12.	a	Dry saturated steam at a pressure of 11 bar enters a convergent divergent nozzle and leaves at a pressure of 2 bar. If the flow is adiabatic and frictionless, determine: (i) exit velocity of steam and (ii) ratio of cross section at exit and that at throat. Assume the index of adiabatic expansion to be 1.135.	L3	2	16
		Or			

	b	Steam at a pressure of 10.5 bar and 0.95 dryness is expanded through a convergent-divergent nozzle and the pressure of steam leaving the nozzle is 0.85 bar. Determine the velocity at the throat for maximum discharge conditions and mass rate of flow of steam through the nozzle. Index of expansion may be assumed as 1.135.	L3	2	16
13.	a	A single stage impulse turbine rotor has a diameter of 1.2 m running at 3000 rpm. The nozzle angle is 18^0. Blade speed ratio is 0.42. The ratio of the relative velocity at outlet to relative velocity at inlet is 0.9. The outlet angle of the blade is 3^0 smaller than the inlet angle. The steam flow rate is 5 kg/s. Draw the velocity diagram and determine the velocity of whirl, Axial thrust on the bearing, Blade angles and Power developed.	L3	3	16
		Or			
	b	Air enters the compressor of an open cycle constant pressure gas turbine at a pressure of 1 bar and temperature 20 ^{0}C. The pressure of the air after compression is 4 bar. The isentropic efficiencies of compressor and turbine are 80% and 85% respectively. The air-fuel ratio used is 90:1. If the flow rate of air is 3kg/s, determine the power developed and thermal efficiency of the cycle. Assume Cp=1 kJ/kg K, γ = 1.4 and calorific value of fuel = 41800 kJ/kg.	L3	3	16
14.	a	Illustrate the typical theoretical and actual valve timing diagram for four stroke petrol engine and the significance of each angle in the valve timing diagram with neat sketches.	L2	4	16
		Or			
	b	Compare and contrast SI and CI engines based on geometric features, operating characteristics and performance.	L2	4	16
15.	a	Illustrate the construction and working of magneto coil ignition system with a neat sketch and infer its advantages and disadvantages.	L2	5	16
		Or			
	b	Explain the various methods of turbocharging with necessary diagrams and infer their advantages and disadvantages.	L2	5	16