Register No: _____

THE KAVERY ENGINEERING COLLEGE

(An Autonomous Institution)

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

Fourth Semester

Mechanical Engineering

ME3451 – Thermal Engineering

(Use of Approved Steam Tables and Mollier Charts are 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.	What are the assumptions made in air standard cycle?	L1	1	2
2.	How would you differentiate between the reheat and regenerative cycles?	L2	1	2
3.	Define nozzle efficiency.	L1	2	2
4.	What is meant by metastable flow?	L2	2	2
5.	Explain the significance of velocity diagram.	L2	3	2
6.	List out the methods of improving the performance of gas turbine power plant.	L1	3	2
7.	What are the differences between CI and SI engines?	L1	4	2
8.	Can you explain the term “Knocking”.	L2	4	2
9.	Why emission testing is required in terms of performance evaluation of internal combustion engines?	L1	5	2
10.	Can you explain the need for a lubrication system?	L2	5	2

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

Q.No			*Questions*	*BLT*	*CO*	*Marks*
11.	a	i	Find the air standard efficiency expression of the Otto cycle using thermodynamic relations.	L2	1	10
		ii	An air standard Diesel cycle has a compression ratio of 12 and cut off take place at 5.5% of the stroke. Infer the air standard efficiency of the cycle from the given data.	L2	1	6
			Or			
	b		In an ideal steam reheat Rankine cycle, steam enters the high pressure turbine at 30 bar and 420°C and then expands to 7.5 bar. The steam is reheated at constant pressure 7.5 bar and 420°C and expands to 0.1 bar in the low pressure turbine. Find the thermal efficiency and quality of steam leaving the low pressure turbine.	L2	1	16
12.	a		Steam enters a convergent divergent nozzle at 2 MPa and 400°C with a negligible velocity and mass flow rate of 2.5kg/s and it exit at a pressure of 300 KPa. The flow is isentropic between the nozzle	L3	2	16

			entrance and throat and overall nozzle efficiency is 93% Estimate (i) Throat area (ii) exit area.			
			Or			
	b		Dry saturated steam at 2.8 bar is expanded through a convergent nozzle to 1.7 bar. The exit area is 3 cm^3. Determine the exit velocity and mass flow rate for, (i) Isentropic expansion, (ii) Super saturated flow.	L3	2	16
13.	a	i	A single row impulse turbine develops 132.4 KW at a blade speed of 175 m/s using 2 kg of steam per sec. Steam leaves the nozzle at 400m/s. Velocity coefficient of the blade is 0.9. Steam leaves the turbine blades axially. Assuming no shock find the nozzle angle, blade angles at entry and exit.	L2	3	10
		ii	What is the difference between impulse and reaction turbine?	L2	3	6
			Or			
	b	i	In a gas turbine power plant, air enters the compressor at 15°C and it is compressed through a pressure ratio 4 with isentropic efficiency of 85%. The air fuel ratio is 80 and the calorific value of fuel is 42,000 KJ/Kg. The turbine inlet temperature is 1000K and the isentropic efficiency of turbine is 82 %. Find overall plant efficiency.	L2	3	10
		ii	How does an open cycle gas turbine differ from a closed cycle gas turbine?	L2	3	6
14.	a		Develop a step-by-step explanation of the construction and working principle of a four-stroke engine, supported by a neat diagram.	L3	4	16
			Or			
	b		Build a comprehensive explanation of the combustion stages in a CI engine.	L3	4	16
15.	a		Construct a clear explanation and labeled diagram to demonstrate the working principle of the common rail injection system.	L3	5	16
			Or			
	b		Identify the differences and working principles of supercharging and turbocharging, and illustrate them using a labeled diagram.	L3	5	16