Register No : _____

THE KAVERY ENGINEERING COLLEGE

(An Autonomous Institution)

B.E/B.TECH DEGREE END SEMESTER THEORY EXAMINATIONS, NOV /DEC 2024

Fourth Semester

Mechanical Engineering

ME3451–Thermal Engineering

(Steam table 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.	Outline the assumptions for air standard cycle.	UN	1	2
2.	Explain mean effective pressure.	UN	1	2
3.	Illustrate the effect of friction on the flow through a steam nozzle.	UN	2	2
4.	Define critical pressure ratio.	UN	2	2
5.	Classify the steam turbines.	UN	3	2
6.	Show the schematic diagram of closed cycle gas turbine.	UN	3	2
7.	Compare SI and CI engine.	UN	4	2
8.	What do you understand by the term scavenging.	RE	4	2
9.	What is indicated power?	RE	5	2
10.	Summarize the effect of supercharging	UN	5	2

*PART – B (ANSWER ALL QUESTIONS) (Marks 5*13 = 65)*

Q.No		*Questions*	*BLT*	*CO*	*Marks*
11.	a	Derive an expression for the thermal efficiency of a diesel engine.	AP	1	13
		Or			
	b	An ideal Otto cycle has a compression ratio of 7. At the beginning of the compression process, p_1 = 90 kPa, T_1 = 27^{0}C and v_1= 0.004m^3. The maximum cycle temperature is 1127^{0}C. Solve the heat rejection, network done, thermal efficiency and mean effective pressure.	AP	1	13
12.	a	A steam nozzle is supplied 10 kg/s steam at 15 bar and 350^{0}C and discharges steam at 1 bar. Assuming isentropic flow and negligible inlet velocity, solve (i) the throat area (ii) exit velocity and (iii) exit area	AP	2	13
		Or			
	b	Dry saturated steam at a pressure of 8 bar enters a convergent – divergent nozzle and leaves it at a pressure of 1.5 bar. If the flow is isentropic and the corresponding expansion index is 1.135,solve the ratio of cross-sectional area at exit and throat for maximum discharge.	AP	2	13

13.	a	i	Define the following as related to steam turbine: a) Speed ratio b) Blade velocity coefficient c) Diagram efficiency d) Stage efficiency	UN	3	8
		ii	What is the need of a intercooler in a gas turbine.	UN	3	5
			Or			
	b		Why is a reheat cycle more efficient than a simple brayton cycle? Justify your answer.	UN	3	13
14.	a		Compare a petrol engine and a diesel engine in terms of operation, construction and thermal efficiency.	AN	4	13
			Or			
	b		Analyze the following: (i)Pre-ignition (ii) Auto-ignition (iii) Detonation	AN	4	13
15.	a		Apply your understanding of lubrication principle to reduce engine wear in high performance engine.	AP	5	13
			Or			
	b		The output of the engine is measured by a rope brake dynamometer. The diameter of the brake pulley is 800 mm and rope diameter is 50 mm. The dead load on the tight side of the rope is 450 N and the spring balance reading is 50 N. The engine consumes 4.5 kg/hr of fuel at rated speed of 1000 rpm. The calorific value of the fuel is 44 MJ/kg. Determine brake specific fuel consumption and brake thermal efficiency.	AP	5	13

*PART – C (Marks 1*15 = 15)*

Q.No			*Questions*	*BLT*	*CO*	*Marks*
16.	a		A simple impulse turbine has one ring of moving blades running at 150 m/s. The absolute velocity of steam at exit from the stage is 85 m/s at an angle of 80^0 from the tangential direction. Blade velocity coefficient is 0.82 and the rate of steam flowing through the stage is 2.5 kg/s. If the blades are equiangular, determine: (i) Blade angles (ii) Nozzle angle (iii) Absolute velocity of steam issuing from the nozzle (iv) Axial thrust	AN	3	15
			Or			
	b		Classify the different types of lubrication system and explain wet sump lubrication system in detail.	AN	5	15