Reg. No.															

Question Paper Code	14552

B.E. / B.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2026

Fourth Semester

Mechanical Engineering

24MEPC401 - THERMAL ENGINEERING

Regulations - 2024

(Use of Steam table, Mollier Chart, Refrigeration Tables, and Psychrometry Chart is permitted)

Duration: 3 Hours | Max. Marks: 100

PART – A (i) (MCQ)
(16 × 1 = 16 Marks)
Answer ALL Questions

		Marks	K – Level	CO
1.	The working fluid in air standard cycles is assumed as a) Steam b) Air c) Refrigerant d) Fuel	1	K1	CO1
2.	The efficiency of Brayton cycle mainly depends on a) Pressure ratio b) Bore diameter c) Stroke length d) Swept volume	1	K2	CO1
3.	Which cycle gives the highest efficiency for the same compression ratio? a) Otto cycle b) Brayton cycle c) Diesel cycle d) Dual cycle	1	K3	CO1
4.	Fans are mainly used for a) High pressure rise b) Refrigeration c) Fuel injection d) Low pressure rise	1	K2	CO2
5.	Blowers are distinguished from fans by a) Lower flow rate b) Higher temperature c) Higher pressure ratio d) Lower efficiency	1	K3	CO2
6.	Which compressor has higher volumetric efficiency? a) Single stage compressor b) Fan c) Multi-stage compressor with intercooling d) Blower	1	K1	CO2
7.	In a four-stroke engine, one power stroke occurs in a) One revolution b) Three revolutions c) Four revolutions d) Two revolutions	1	K3	CO3
8.	Compared to SI engines, CI engines generally have a) Lower efficiency b) Lower torque c) Lower compression ratio d) Higher thermal efficiency	1	K2	CO3
9.	Governing of engines is mainly used to a) Reduce lubrication b) Control engine speed c) Increase smoke d) Reduce compression ratio	1	K3	CO3
10.	Which boiler is suitable for high pressure applications? a) Cochran boiler b) Water tube boiler c) Lancashire boiler d) Fire tube boiler	1	K1	CO4

11.	Water tube boilers are preferred because they		*1*	*K3*	*CO4*
	a) Have lower efficiency	b) Consume more fuel			
	c) Occupy larger space only	d) Produce steam at high pressure quickly			
12.	Cogeneration systems improve overall efficiency by		*1*	*K2*	*CO4*
	a) Wasting heat	b) Reducing steam generation			
	c) Utilizing waste heat	d) Increasing fuel loss			
13.	Nozzles are used to convert		*1*	*K1*	*CO5*
	a) Pressure energy into kinetic energy	b) Heat into work directly			
	c) Kinetic energy into pressure energy	d) Mechanical energy into pressure energy			
14.	Multi-stage turbines are preferred because they		*1*	*K1*	*CO5*
	a) Reduce efficiency	b) Increase moisture losses			
	c) Improve efficiency and power output	d) Increase friction losses			
15.	COP of a refrigerator is defined as		*1*	*K2*	*CO6*
	a) Heat rejected / Work input	b) Heat rejected / Work input			
	c) Work output / Heat supplied	d) Pressure ratio / Work input			
16.	Cooling load calculation is essential for		*1*	*K3*	*CO6*
	a) Fuel combustion	b) Boiler mounting selection			
	c) Proper air conditioning design	d) Turbine governing			

PART – A (ii) (Short Answer Questions)
(6 × 3 = 18 Marks)

Answer ALL Questions

17.	Construct the P-V and T-S diagram for Brayton cycle.	*3*	*K4*	*CO1*
18.	A single-acting, single-stage reciprocating air compressor takes in air at 1 bar and 27°C, and delivers it at 8 bar. The compressor has a bore of 80 mm and a stroke of 120 mm, running at 450 rpm. Assuming the compression follows the polytropic process $PV^{1.3}$ = Constant, and clearance volume is negligible, calculate the power required to drive the compressor (in kW). *(Use R=0.287 kJ/kg K and take π= 3.1416)*	*3*	*K3*	*CO2*
19.	Compare Two stroke and Four stroke of I.C. engine.	*3*	*K3*	*CO3*
20.	Examine the functions of essential boiler mountings and justify their importance in maintaining boiler performance and safety.	*3*	*K3*	*CO4*
21.	In a simple impulse turbine, the nozzle angle at the entrance is 30°.What will be the blade-speed ratio for maximum diagram efficiency?	*3*	*K4*	*CO5*
22.	An ideal refrigerator maintains a temperature of – 23°C when placed inside a room at 27°C. Heat infiltration into the refrigeration is 0.5 kJ/s. What will be the power required to pump the heat out.	*3*	*K4*	*CO6*

PART - B (Descriptive Answer Questions)
(6 × 11 = 66 Marks)

Answer ALL Questions

23.	a)	An engine working on Otto cycle has a volume of $0.45m^3$, pressure 1 bar and temperature 30°C at the beginning of compression stroke. At the end of compression stroke, the pressure is 11 bar. 210kJ of heat is added at constant volume. Solve the following, (i) Pressures, temperatures and volumes at salient points in the cycle (ii) Efficiency (iii)Work done	*11*	*K4*	*CO1*

OR

	b)	Evaluate the performance of a Diesel cycle by deriving the efficiency equation and interpreting the thermodynamic processes shown in P–V and T–S diagrams.	*11*	*K4*	*CO1*
24.	a)	Apply the working principle of a single-stage reciprocating compressor with neat sketch.	*11*	*K3*	*CO2*
		OR			
	b)	A single stage, single acting air compressor 30 cm bore and 40 cm stroke runs at 200 rpm. The suction pressure is 1 bar at 15°C and the delivery pressure 5 bar. Determine ideal power required to run it, when: (i) Compression is isothermal (ii) Compression follows the law $pv^{1.25}$= C (iii) Compression is reversible adiabatic (γ=1.4) Assume isentropic or reversible adiabatic index as γ=1.4 and R= 0.287 kJ/kg K .	*11*	*K3*	*CO2*
25.	a)	Analyze the structure of pressure lubrication system of I.C. Engine.	*11*	*K3*	*CO3*
		OR			
	b)	Analyze the sequence of operations in a four-stroke SI engine and represent the cycle using a suitable diagram.	*11*	*K3*	*CO3*
26.	a)	Apply the working principle of Benson boiler with the help of construction.	*11*	*K3*	*CO4*
		OR			
	b)	Draw neat sketches and describe the working principle of any two boiler accessories in a steam boiler.	*11*	*K3*	*CO4*
27.	a)	In a De-Laval turbine steam issues from the nozzle with a velocity of 1300 m/s. The nozzle angle is 20°, the mean blade velocity is 450 m/s, the inlet and outlet angles of blades are equal. The mass of steam flowing through the turbine per hour is 1200 kg. Calculate: (i) Blade angles, (ii) Relative velocity of steam entering the blades, (iii)Tangential force on the blades, (iv) Power developed (v) Blade efficiency, Take blade velocity co-efficient as 0.75	*11*	*K3*	*CO5*
		OR			
	b)	Analyze the various methods of governing steam turbines.	*11*	*K3*	*CO5*
28.	a)	Construct the vapor absorption refrigeration cycle and analyze its working concepts.	*11*	*K4*	*CO6*
		OR			
	b)	A simple saturation refrigeration cycle developing 15 tons of refrigeration using R12 operates with a condensing temperature of 35°C and an evaporator temperature of – 6°C. Calculate: (i) The refrigerating effect, (ii) Refrigerant flow rate, (iii) The power required to drive the compressor, (iv) COP.	*11*	*K4*	*CO6*