Reg. No.															

Question Paper Code	13644

B.E. / B.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2025

Fourth Semester

Mechanical Engineering

20MEPC404 - THERMAL ENGINEERING

Regulations - 2020

(Use of Steam Tables, Molier Chart, Refrigeration Tables is permitted)

Duration: 3 Hours Max. Marks: 100

PART - A (MCQ) (10 × 1 = 10 Marks)

Answer ALL Questions

		Marks	*K – Level*	*CO*
1.	In the diesel cycle, the compression process is (a) Isothermal (b) Adiabatic (c) Constant pressure (d) Constant volume	*1*	*K1*	*CO1*
2.	What is a defining feature of the dual cycle? (a) Constant volume and constant pressure heat addition (b) Only constant volume heat addition (c) Only constant pressure heat addition (d) No heat addition	*1*	*K1*	*CO1*
3.	A steam nozzle covert (a) The heat energy of steam into kinetic energy (b) The potential energy of steam into kinetic energy (c) The kinetic energy of steam into mechanical energy (d) The heat energy of steam into mechanical energy	*1*	*K1*	*CO2*
4.	The following are the method for compounding except (a) Velocity compounding (b) Pressure compounding (c) Volume compounding (d) Reaction turbine	*1*	*K1*	*CO3*
5.	Aero planes employs following type of compressor..... (a) Radial flow (b) Axial flow (c) Centrifugal (d) Combination of above	*1*	*K1*	*CO4*
6.	Volumetric efficiency of air compressors is of the order of..... (a) 20 to 30% (b) 40 to 50% (c) 60 to 70% (d) 70 to 90%	*1*	*K1*	*CO4*
7.	In a four-stroke cycle engine, one cycle is completed in the following degree of the crankshaft (a)720 (b) 360 (c) 540 (d) 180	*1*	*K2*	*CO5*
8.	In a two-stroke engine, ports are operated by movement of (a) Crank (b) Piston (c) Connecting rod (d) Piston pin	*1*	*K1*	*CO5*
9.	The COP of a vapour compression plant in comparison to vapour absorption plant is (a) More (b) Less (c) Same (d) Depends on the size of the plant	*1*	*K2*	*CO6*
10.	The sequence of components in the vapour compression refrigeration system is (a) Compressor, Condenser, Expansion device, Evaporator (b) Compressor, Condenser, evaporator, Expansion device (c) Expansion devise, Compressor, Condenser, Evaporator (d) Compressor, Evaporator, Condenser, Expansion device	*1*	*K2*	*CO6*

PART - B (12 × 2 = 24 Marks)

Answer ALL Questions

11.	Write any four major differences between Otto and diesel cycle.	*2*	*K2*	*CO1*
12.	Define the following terms (i) Compression ratio (ii) Cut off ratio.	*2*	*K1*	*CO1*
13.	If the enthalpy drops in a steam nozzle of efficiency 92% is 100 kJ/kg, determine the exit velocity of steam.	*2*	*K2*	*CO2*
14.	Express the effects of friction on the flow through a steam nozzle.	*2*	*K2*	*CO2*

15.		Define degree of reaction.	2	K1	CO3
16.		Enumerate the energy losses in steam turbines.	2	K2	CO3
17.		List different types of Compressors.	2	K1	CO4
18.		Draw the P-V diagram for a single stage reciprocating air compressor.	2	K2	CO4
19.		Compare Petrol and Diesel engines.	2	K2	CO5
20.		What is the function of push rod and rocker arm?	2	K1	CO5
21.		Define the COP of refrigeration.	2	K1	CO6
22.		What are the properties of good refrigerants?	2	K1	CO6

PART - C (6 × 11 = 66 Marks)

Answer ALL Questions

23.	a)	An engine working on Otto Cycle has a volume of 0.45 cubic meter, pressure 0.1 M Pa and temperature 303 K at the beginning of compression stroke. At the end of compression stroke, the pressure is 11 bar and 201 KJ of heat is supplied at constant volume, Calculate the following: a) Pressure, Temperature and Volume at salient points in the cycle b) Efficiency.	11	K2	CO1
		OR			
	b)	Derive an expression to find the air standard efficiency of Diesel cycle with P-V and T-S diagrams.	11	K2	CO1
24.	a)	In a steam nozzle, the steam expands from 4 bar to 1 bar. The initial velocity is 60 m/s and the initial temperature is 200°C. Calculate the exit velocity if the nozzle efficiency is 92%.	11	K2	CO2
		OR			
	b)	Derive an expression for maximum discharge through convergent divergent nozzle for steam.	11	K2	CO2
25.	a)	Construct neat diagram and explain velocity compounding, pressure compounding, pressure-velocity compounding.	11	K3	CO3
		OR			
	b)	In De-lavel turbine, the steam enters the wheel through a nozzle with a velocity of 500 m/s and at an angle of 20^0 to the direction of the motion of the blade. The Blade speed is 200 m/s and the exit angle of the moving blood is 25^0. Indentify the inlet angle of the moving blood exit velocity of steam and its direction and work done per kg of steam.	11	K3	CO3
26.	a)	Derive the expression for Work done of multi stage air compressor.	11	K2	CO4
		OR			
	b) (i)	Describe in detail the working principle of single stage reciprocating air compressor with a neat sketch.	6	K2	CO4
	(ii)	With neat sketch, Explain the working of any two Rotary compressors.	5	K2	CO4
27.	a)	Explain the principle of Magneto ignition system enumerate its advantage and disadvantages.	11	K2	CO5
		OR			
	b)	Explain why cooling is necessary in IC engine with a neat sketch describe the working of water cooling system used for multi cylinder engine.	11	K2	CO5
28.	a)	Develop a layout and explain the following refrigeration: Ammonia water system.	11	K3	CO6
		OR			

b) An ammonia refrigerator produces 30 tons of ice at 0^0C in a day of 24 hours. The temperature range in the compressor is from 25^0C to -15^0C. The vapour is dry saturated at the end of compression. Assume a COP of 60% of theoretical value. Indentify the power required to drive the compressor. Assume latent heat of ice is 335kJ/kg, for properties of NH_3, refer the table below. *11 K3 CO6*

Temperature^{0}C	$\mathbf{h_f}$ **(kJ/kg)**	$\mathbf{h_g}$ **(kJ/kg)**	$\mathbf{s_f}$ **(kJ/kgk)**	$\mathbf{s_g}$ **(kJ/kgk)**
25	298.9	1465.8	1.124	5.039
-15	112.34	1426.5	0.4572	5.549