Reg. No.												

Question Paper Code	12506

B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2023

Fourth Semester

Mechanical Engineering

20MEPC404 - THERMAL ENGINEERING

(Use of steam table, Mollier chart and Refrigeration Table are permitted)

(Regulations 2020)

Duration: 3 Hours Max. Marks: 100

PART - A (10 × 2 = 20 Marks)

Answer ALL Questions

		Marks, K-Level, CO
1.	Identify the various processes involved in Diesel Cycle with P V & T S diagram	*2,K2,CO1*
2.	List the assumptions made in deriving Air Standard Cycle efficiency	*2,K1,CO1*
3.	Define critical pressure ratio.	*2,K1,CO2*
4.	What is meant by Pressure Compounding?	*2,K1,CO3*
5.	Differentiate centrifugal compressor and rotary blower.	*2,K2,CO4*
6.	What do you mean by perfect inter-cooling?	*2,K1,CO4*
7.	Define the term Clearance volume.	*2,K1,CO5*
8.	List the various components of engine.	*2,K1,CO5*
9.	What is dew point temperature?	*2,K1,CO6*
10.	Differentiate between heat pump and refrigerator.	*2,K2,CO6*

PART - B (5 × 13 = 65 Marks)

Answer ALL Questions

11.	a)	Develop the Air Standard efficiency for Constant Volume Cycle.	*13,K2,CO1*
		OR	
	b)	Find the air standard efficiencies for the Otto and Diesel cycles on the basis of equal compression ratio of 10 and equal heat rejection of 840 kJ/kg. The suction conditions are 1 bar and 328 K.	*13,K3,CO1*
12.	a)	Construct an expression for critical pressure ratio in terms of index of expansion.	*13,K2,CO2*
		OR	
	b)	Air enters a frictionless adiabatic converging nozzle at 10 bar 500 K with negligible velocity. The nozzle discharges to a region at 2 bars. If the exit area of the nozzle is 2.5 cm^2, find the flow rate of air through the nozzle.	*13,K3,CO2*

13. a) Explain with a neat sketch of velocity compounding, pressure compounding, pressure-velocity compounding. *13,K2,CO3*

OR

b) A single row impulse turbine develops 135 kW at a blade speed of 170 m/s, using 2.2 kg of steam per sec. Steam leaves the nozzle at 500 m/s. Velocity coefficient of the blades is 0.9. Steam leaves the turbine blades axially. Calculate nozzle angle, blade angles at entry and exit, assuming no shock. *13,K3,CO3*

14. a) Drive an expression for the work done by single stage single acting reciprocating air compressor. *13,K3,CO4*

OR

b) Explain with short note on *13,K2,CO4*
   (i) Reciprocating compressor.
   (ii) Centrifugal compressor.
   (iii) Axial flow compressor.

15. a) Explain why cooling is necessary in IC engine with a neat sketch describing the working of water cooling system used for multi cylinder engine. *13,K2,CO5*

OR

b) Explain the combustion phenomenon in SI Engines. *13,K2,CO5*

PART - C (1 × 15 = 15 Marks)

16. a) (i) Explain summer Air Conditioning system with a neat layout. *10,K2,CO6*

(ii) Sketch various processes of summer Air Conditioning system in a Psychometric chart. *5,K2,CO6*

OR

b) An office is to be air conditioned for 50 staff when the outdoor conditions are 30^{o}C DBT and 75% RH if the quality of air supplied is 0.4m^{3}/min/person, find the following: *15,K3,CO6*
   (1) capacity of the cooling coil in tones of refrigeration
   (2) capacity of the heating coil in kW
   (3) amount of water vapour removed per hour

Assume that required air inlet conditions are 20^{o}C DBT and 60% RH, air is conditioned first by cooling and dehumidifying and then by heating.