ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. / B. Tech (Full Time) - END SEMESTER EXAMINATIONS (Arrear) - April/May 2024

MECHANICAL ENGINEERING

V Semester

ME 5501 THERMAL ENGINEERING

Use of Steam tables/ Mollier chart / Psychrometric chart permitted

(Regulation 2019)

Time: 3hrs   Max.Marks: 100

CO1	Determine the fuel properties adopting proximate and ultimate analysis.
CO2	Analyze the performance of different boilers.
CO3	Assess the performance of air compressors under different operating conditions
CO4	Explain the working principles of various refrigeration systems and estimate COP.
CO5	Compute psychrometric properties and design suitable air conditioning systems.

Bloom's Taxonomy Levels (L1 - Remember, L2 - Understand, L3 - Apply, L4 - Analyse, L5 - Evaluate, L6 - Create)

PART- A (10 x 2 = 20 Marks)

(Answer all Questions)

Q. No	Questions	Marks	CO	BL
1	Classify various types of fuels.	2	1	L1
2	Define stoichiometric air–fuel ratio	2	1	L2
3	What is the functions of fusible plug in boilers?	2	2	L1
4	Define equivalent evaporation of the boiler	2	2	L2
5	Differentiate between single-acting and double-acting compressors.	2	3	L1
6	Compare reciprocating compressor with a rotary compressor.	2	3	L2
7	What is sensible heating or cooling?	2	4	L1
8	What do you understand by primary and secondary refrigerants?	2	4	L2
9	What is evaporative cooling?	2	5	L1
10	Define relative humidity.	2	5	L2

PART- B (5 x 13 = 65 Marks)

Q. No	Questions	Marks	CO	BL
11 (a)	Explain the construction and working of bomb calorimeter	13	1	L3
	OR			
11 (b)	Determine the air–fuel ratio and the theoretical amount of air required by mass for complete combustion of a fuel containing 85% of carbon, 8% of hydrogen, 3% of oxygen, 1% of sulphur and the remaining as ash. If 40% of excess air is used, what is the volume of air at 27°C and 1.05 bar pressure? Does this represent per kg of fuel?	13	1	L3
12 (a)	Discuss any two mountings and two accessories of boiler.	13	2	L3
	OR			
12 (b)	Calculate the equivalent evaporation of a boiler per kg of coal fired, if the boiler produces 50,000 kg of wet steam per hour with a dryness fraction of 0.95 and operating at 10 bar. The coal burnt per hour in the furnace is 5500 kg and feed-water temperature is 40°C.	13	2	L3
13 (a)	Describe the principle of operation, construction and working of a Non-positive displacement compressor?	13	3	L3
	OR			
13 (b)	A single-acting, single-cylinder reciprocating air compressor is compressing 20 kg/min. of air from 110 kPa, 30°C to 600 kPa and delivers it to a receiver. Law of compression is $pV^{1.25}$ = constant. Mechanical efficiency is 80%. Find the power input to compressor, neglecting losses due to clearance, leakages and cooling	13	3	L3
14 (a)	Explain the working principle of vapour absorption system. Compare it with vapour compression system.	13	4	L3
	OR			

14 (b)	The pressure in the evaporator of an ammonia refrigerator is 1.902 bar and the pressure in the condenser is 12.37 bar. Calculate the refrigeration effect per unit mass of the refrigerant and $(COP)_R$ for the the dry saturated vapour delivered to the condenser after isentropic compression and no undercooling of the condensed liquid and then throttling of refrigerant to evaporator pressure	13	4	L3
15 (a)	Explain summer air-conditioning systems with the help of a schematic.	13	5	L3
	OR			
15 (b)	Air is cooled from 39°C DBT and 29% RH to 24°C at the rate of 5 m³/s. Calculate the capacity of the cooling coil if the surface of the cooling coil is 20 °C. Also, calculate the bypass factor.	13	5	L3

PART- C (1 x 15 = 15 Marks)

(Q.No.16 is compulsory)

Q. No	Questions	Marks	CO	BL
16.	Air at 40°C DBT and 25°C WBT is cooled down in an air-conditioning plant to 25°C DBT and 60% RH. Calculate the heat to be removed per kg of air if the COP of the unit is 3.5. Also, find the work required to cool 3 kg of air.	15	5	L4

ADDITIONAL CONTROLLER OF EXAMINATION
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