KUMARAGURU
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B.E DEGREE EXAMINATIONS: NOV/DEC 2022

(Regulation 2018)

Third Semester

MECHANICAL ENGINEERING

U18MET3003 Engineering Thermodynamics

COURSE OUTCOMES

CO1:   Illustrate basic concepts for solving problems in open and closed system.

CO2:   Apply second law concepts to heat engine and heat pumps.

CO3:   Apply concepts of entropy.

CO4:   Compare the performance of various vapor power cycles.

CO5:   Illustrate the significance of thermodynamics relations.

CO6:   Solve problems in various psychrometric processes.

Time: Three Hours   **Maximum Marks: 100**

Answer all the Questions:-
Use of psychrometric chart and steam tables are permitted
PART A (10 x 2 = 20 Marks)
(Answer not more than 40 words)

1.	Illustrate types of System with an example.	CO1	[K1]
2.	Restate Perpetual Motion machine of first kind.	CO2	[K2]
3.	Define the term 'available energy'	CO3	[K2]
4.	Write the relation between COP of Heat pump and COP of Refrigerator.	CO2	[K1]
5.	Recall Dryness fraction and Wetness fraction.	CO4	[K1]
6.	Mention the improvements made to increase the ideal efficiency of Rankine cycle.	CO4	[K3]
7.	Discriminate ideal and real gas using compressibility factor.	CO5	[K2]
8.	Recall Dalton's Law of Partial pressure.	CO5	[K1]
9.	Infer on Dew point depression.	CO6	[K4]
10.	Define Sensible heat factor.	CO6	[K1]

Answer any FIVE Questions:-
PART B (5 x 16 = 80 Marks)
(Answer not more than 400 words)

11.   A fluid system, contained in a piston and cylinder machine, passes through a   16   CO1   [K5]
complete cycle of four processes. The sum of all heat transferred during a cycle is
– 340 kJ. The system completes 200 cycles per min. Complete the following table
showing the method for each item, and compute the net rate of work output in kW.

Process	Q (kJ/min)	W (kJ/min)	ΔE (kJ/min)
1-2	0	4340	-
2-3	42000	0	-
3-4	-4200	-	-73200
4-1	-	-	-

12. a) A heat source at 627°C transfer heat at the rate of 3000 kJ/min to a system   16   CO3   [K₃]
remaining at 287°C. There is available a heat sink at 27°C. Assuming that these
temperatures remain constant, find

   a) Change in entropy of the source

   b) The entropy production accompanying the heat transfer

   c) The original available energy

   d) The available energy after heat transfer

13.   A reversible heat engine operates between two reservoirs at temperatures 700°C   16   CO2   [K₅]
and 50°C. The engine drives a reversible refrigerator which operates between
reservoirs at temperatures of 50°C and – 25°C. The heat transfer to the engine is
2500 kJ and the net work output of the combined engine refrigerator plant is 400
kJ. (i) Determine heat transfer to the refrigerant and the net heat transfer to the
reservoirat 50°C (ii) Reconsider given that efficiency of the heat engine and the
C.O.P. of the refrigerator are each 45 per cent of their maximum possible values.

14. a) Calculate the specific volume and enthalpy of wet steam at 18 bar and dryness   8   CO4   [K₄]
fraction of 0.85.

b) Compute the dryness fraction and specific volume of steam at 7 bar and enthalpy of 2550 kJ/kg. 　　8　CO4　[K5]

15. The sling psychrometer in a laboratory test recorded the following readings :　16　CO6　[K5]
Dry bulb temperature = 35°C, Wet bulb temperature = 25°C.
Calculate the following : (i) Specific humidity (ii) Relative humidity
(iii) Vapour density in air (iv) Dew point temperature (v) Enthalpy of mixture per
kg of dry air ,Take atmospheric pressure = 1.0132 bar.

16. Derive the all four Maxwell's thermodynamic relations for a pure substance　16　CO5　[K4]
existing in single phase in terms of pressure, volume, temperature, entropy,
internal energy, enthalpy, Helmholtz function and Gibbs function.

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