Register Number:……………..

B.E DEGREE EXAMINATIONS: NOV/DEC 2024

(Regulation 2018)

Third Semester

MECHANICAL ENGINEERING

U18MET3003: Engineering Thermodynamics

(Use of approved Steam Tables, Psychrometric chart, gas tables and Refrigeration charts are permitted)

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: -
PART A (10 x 2 = 20 Marks)
(Answer not more than 40 words)

1.	Differentiate between open and closed systems.	CO1	[K_2]
2.	Define specific heat capacity and its significance	CO1	[K_2]
3.	Define the Carnot theorem.	CO2	[K_2]
4.	Describe the Coefficient of Performance (COP) of a refrigerator.	CO2	[K_2]
5.	Define entropy and explain its physical significance	CO3	[K_2]
6.	Compare Rankine and modified Rankine cycles.	CO4	[K_2]
7.	What are the key differences between ideal and real gases?	CO4	[K_2]
8.	Explain the concept of the compressibility factor.	CO5	[K_2]
9.	Define Dalton's law of partial pressure.	CO5	[K_1]
10.	Write the significance of psychrometric charts.	CO6	[K_2]

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

11. A gas turbine power plant operates with a simple Brayton cycle. The air enters the compressor at atmospheric pressure (1 bar) and 300 K, and it is compressed

to 6 bar. The turbine inlet temperature is 1200 K. Assume ideal gas behavior and isentropic efficiency for both the compressor and turbine as 85%. The gas constant for air is R = 0.287 kJ/kg·K, and the specific heat ratio is $\gamma = 1.4$. Determine:

			Marks	CO	K
	a)	The work input to the compressor.	7	CO1	[K_4]
	b)	The thermal efficiency of the cycle.	7	CO2	[K_3]
	c)	The entropy change in the compressor.	2	CO3	[K_2]
12.		A refrigerator working on an ideal vapor-compression cycle has a refrigerant R-134a entering the evaporator at 1.4 bar and -10°C. The refrigerant exits the evaporator as saturated vapor and enters the condenser at 10 bar and 60°C. Assume ideal processes and use thermodynamic tables for R-134a. Determine:			
	a)	The cooling effect produced per kg of refrigerant.	7	CO2	[K_4]
	b)	The work input to the compressor.	7	CO3	[K_3]
	c)	The COP of the refrigerator.	2	CO1	[K_2]
13.	a)	Analyze the entropy change for an ideal gas undergoing isothermal expansion.	7	CO3	[K_4]
	b)	Apply the first law of thermodynamics to a closed system undergoing an adiabatic process.	7	CO1	[K_3]
	c)	Discuss the significance of the specific heat at constant pressure (Cp).	2	CO2	[K_2]
14.	a)	Compare the Rankine cycle with reheat and regenerative Rankine cycles.	7	CO4	[K_4]
	b)	Explain Maxwell's thermodynamic relations.	7	CO5	[K_3]
	c)	Discuss the Joule-Thomson effect.	2	CO6	[K_2]
15.	a)	Evaluate the thermodynamic properties of a real gas using the compressibility chart.	7	CO5	[K_4]
	b)	Calculate the mass flow rate of air in a psychrometric process when given the humidity ratio and specific enthalpy.	7	CO6	[K_3]
	c)	Explain the relationship between the wet-bulb temperature and relative humidity.	2	CO4	[K_2]
16.	a)	Analyze the performance of an ideal gas during isobaric expansion.	7	CO6	[K_4]
	b)	Discuss the significance of Clausius Clapeyron equations in phase transitions.	7	CO4	[K_3]
	c)	Explain Dalton's law in the context of gas mixtures.	2	CO5	[K_2]

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