PVP 20

Code: 20ME6402

II B.Tech - II Semester – Regular Examinations – MAY 2023

ADVANCED THERMODYNAMICS
(HONORS in MECHANICAL ENGINEERING)

Duration: 3 hours Max. Marks: 70

Note: 1. This paper contains questions from 5 units of Syllabus. Each unit carries 14 marks and have an internal choice of Questions.
2. All parts of Question must be answered in one place.

BL – Blooms Level CO – Course Outcome

			BL	CO	Max. Marks
UNIT-I					
1	a)	Explain mechanical, thermal and chemical irreversibilities.	L2	CO1	7 M
	b)	A house, initially at a temperature T_1 during a hot summer day, must be cooled to a temperature T_2, while the ambient temperature is T_0. Obtain an expression for the minimum work required. If T_0 = 310 K, T_1 = 310 K, T_2 = 294 K, C_{v0} = 0.718 kJ/ kg.K. Determine the minimum work required to cool a house containing a living area of 200 m^2 with equivalent mass of 50 kg/ m^2 of living area.	L3	CO1	7 M
OR					
2	a)	What are different laws of thermodynamics? Explain them along with the properties developed based on these	L2	CO1	7 M

		laws.			
	b)	Explain the concept of Irreversibility and entropy of an Isolated system with an example.	L2	CO1	7 M
		UNIT-II			
3	a)	What are the Maxwell relations and explain the significance of each Maxwell relation?	L3	CO1	7 M
	b)	Explain about Mayer's relation and Specific heat relations.	L3	CO2	7 M
		OR			
4	a)	Explain about enthalpy correction charts.	L2	CO2	7 M
	b)	Derive Clausius Clapeyron equation.	L2	CO2	7 M
		UNIT-III			
5		A certain mass of air is contained in a vessel of 0.142 m^3 capacity at pressure and temperature of 23.1 bar and 18^oC respectively. A valve is opened momentarily and the pressure falls immediately to 6.9 bar. Sometime later the temperature is again 18^oC and the pressure is observed to be 9.1 bar. Estimate the value of specific heat ratio.	L3	CO2	14 M
		OR			
6	a)	Derive the expression to evaluate entropy of perfect gas mixtures.	L2	CO2	7 M
	b)	At steady state, 100m^3/min. of dry air at 32^0C and 1bar is mixed adiabatically with a stream of Oxygen(O_2) at 127^0C and 1bar to	L3	CO2	7 M

		form a mixed stream at 47^0C and 1bar. The kinetic and potential energy effects are negligible. Determine (i) mass flow rates of dry air and Oxygen in kg/min. (ii) the mole fraction of dry air and Oxygen in the existing mixture, and (iii) time rate of entropy production, in kJ/min.			
UNIT-IV					
7	a)	Determine the adiabatic flame temperature of the diesel fuel C_{12} H_{26} with 100% excess air and also with 100% theoretical air.	L3	CO3	7 M
	b)	Octane C_8H_{18} is burned with dry air at P = 14.7 psia. i) Calculate stoichiometric A: F ratio. If volumetric analyses of dry products are CO_2: 7%, O_2: 10.90%, N_2: 82.10%, then determine ii) equivalence ratio for actual combustion.	L3	CO3	7 M
OR					
8	a)	Explain chemical equilibrium relations with an example.	L2	CO3	7 M
	b)	Calculate the maximum power developed and irreversibility of a chemical reaction process of fuel C_8 H_{18} burnt with 200% theoretical air. The products of combustion leave at 1000 K and the ambient temperature is 288 K.	L3	CO3	7 M

UNIT-V					
9	a)	Explain the factors effecting flame velocity and flame thickessness in combustion process.	L2	CO3	7 M
	b)	Discuss about diffusion flame.	L2	CO3	7 M
OR					
10	a)	How flammability effects the combustion process. Explain.	L2	CO3	7 M
	b)	Explain about flame stabilization.	L2	CO3	7 M