19/02/2025

O.P.Code: 20ME3101	R20	H.T.No.									

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY:: PUTTUR
(AUTONOMOUS)
M.Tech I Year I Semester Regular & Supplementary Examinations February-2025
THERMODYNAMICS AND COMBUSTION
(Thermal Engineering)

Time: 3 Hours **Max. Marks: 60**

(Answer all Five Units **5 x 12 = 60** Marks)

UNIT-I

1		Derive an energy balance relation for a reacting closed system undergoing a quasi-equilibrium constant pressure expansion or compression process.	CO1	L3	12M
		OR			
2		Air at 5000 kPa and 300 K is flowing through a pipeline. An evacuated and insulated cylinder of volume 0.1 m3 is connected to the pipeline through a valve. The valve is opened and the cylinder is filled with air till the pressure in the cylinder reaches the line pressure. The valve is then closed. Assuming that the air behaves like an ideal gas with k=1.4, determine the temperature of the air in the cylinder at the end of the filling operation and the mass of air that is filled in the cylinder.	CO1	L5	12M

UNIT-II

3	a	One kmol of octane C_8H_{18} is burned with air that contains 20kmol of O_2. Assuming the product contains only CO_2, H_2O, O_2 and N_2, determine the mol number of each gas in the products and the air-fuel ratio for this combustion process.	CO2	L5	6M
	b	How does the presence of N_2 in air affects the outcome of a combustion process. What does the dew point temperature of the product gases represent? How it is determined?	CO2	L1	6M
		OR			
4		Aceteylene C_2H_2 is burned with stoichiometric amount of air during a combustion process, assume complete combustion determine air-fuel ratio on a mass basis and on a mole basis.	CO2	L5	12M

UNIT-III

5		A gases fuel with 80% CH_4, 15 percent N_2 and 5 percent O_2 is burned with dry air that enters the combustion chamber at 25 degree and 100kpa. The volumetric analysis of the product on a dry basis is 3.36% CO_2, 0.09% CO, 14.91% O_2 and 81.64% N_2. Detremine the air-fuel ratio, percent theoretical air used, volume flow rate and air used to burn fuel at a rate of 1.4kg/min.	CO3	L5	12M
		OR			
6		Octane C_8H_{18} is burned with 250% theoretical air, which enters the combustion chamber at 25 degree C, assuming complete combustion and a total pressure of 1 atm, determine air-fuel ratio and dew point temperature of the product.	CO3	L5	12M

UNIT-IV

7	Explain with neat sketch of air aspiration gas burner.	CO4	L2	12M

OR

8	Design an burner which uses gas as a fuel and the flow rate of oil is 20cc per minute.	CO4	L6	12M

UNIT-V

9	Describe thermo-ionic energy system with neat sketch and list out the materials use in it.	CO4	L2	12M

OR

10	Design an solar power panal using PV CELL to operate an pump motor of capacity 7HP runs continuously for 4 hours at full load condition and the s total ead id 20m.	CO4	L6	12M

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