Code No.: ME305PC | R20 | H.T.No. | | | 8 | R | | | | | |

CMR ENGINEERING COLLEGE: : HYDERABAD
UGC AUTONOMOUS
II–B.TECH–I–Semester End Examinations (Supply) - February - 2023
THERMODYNAMICS
(MECH)

[Time: 3 Hours] **[Max. Marks: 70]**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 20 marks. Answer all questions in Part A.
Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART-A **(20 Marks)**

1. a) Define irreversible process. Give examples. [2M]
   b) State zeroth law of thermodynamics. [2M]
   c) Write the differential form of the steady flow energy equation. [2M]
   d) State Kelvin-Planck statement. [2M]
   e) Define p-v-T surface and state its significance. [2M]
   f) Write down the equation of state of an ideal gas. [2M]
   g) Define Specific humidity and relative humidity. [2M]
   h) State Avagadro's law. [2M]
   i) Differentiate between Sterling and Ericsson Cycles. [2M]
   j) State elements of vapour compression refrigeration system. [2M]

PART-B **(50 Marks)**

2. A fluid at a pressure of 3 bar and with specific volume of 0.18 m^3/kg, contained in a cylinder behind a piston expands reversibly to a pressure of 0.6 bar according to a law, $p = (C/v^2)$ where C is a constant. Calculate the work done by the fluid on the piston. [10M]

OR

3.a) Compare Macroscopic and Microscopic approaches in thermodynamic studies. [5M]
   b) Explain about point function and path function with examples. [5M]

4.a) A cyclic heat engine operates between a source temperature of 800°C and a sink temperature of 30°C and heat supply to heat engine is 50kW. What is the least rate of the heat rejection per kW net output of the engine? [6M]
   b) Apply first law to a process and a cycle. [4M]

OR

5.a) Explain in detail about Clausius inequality. [5M]
   b) 3 kg of air is expanded at constant pressure to three times its initial volume. Calculate the change in entropy if the initial temperature of the air is 300°C. [5M]

6. Steam at a pressure of 5 bar passes into a tank containing water where it gets condensed. The mass and temperature in the tank before the admission of steam are 50 kg and 20°C respectively. Calculate the dryness fraction of steam as it enters the tank if 3 kg of steam gets condensed and resulting temperature of the mixture becomes 40°C. Take water equivalent of tank as 1.5 kg. [10M]

OR

7.a) Explain Throttling process and Free expansion process. [5M]

b) 0.3 m^3 of air at pressure 8 bar expands to 1.5 m^3. The final pressure is 1.3 bar. Assuming the expansion to be polytropic. Calculate the heat supplied and change of internal energy. Assume $\gamma=1.4$ [5M]

8.a) A gas mixture consists of 0.4 kg CO, 1.1 kg of CO_2 and 1.5 kg of N_2. Determine [6M]
   i. Mass fraction of each component.
   ii. Mole fraction of each component.
   iii. Gas constant of the mixture.

b) Write a short note on the Gravimetric Analysis. [4M]

OR

9.a) State Daltons law of partial pressure. [2M]

b) Define DBT, WBT, Dew point temperature and degree of saturation. [8M]

10. Derive an expression for efficiency of Otto cycle. Draw p-V and T-s diagrams. [10M]

OR

11. Explain the working of Bell-Coleman cycle and derive the expression for COP. [10M]

****