Code No: **R201254** **R20** **SET - 1**

I B. Tech II Semester Supplementary Examinations, January/February - 2023

THERMODYNAMICS

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

Answer any FIVE Questions ONE Question from Each Unit
All Questions Carry Equal Marks

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UNIT - I

1 a) Classify the types of systems, explain the energy conversion in them. [6M]

b) To a closed system 150 kJ of work is supplied. If the initial volume is 0.6 m^3 and pressure of the system changes as p = 8 – 4V, where p is in bar and V is in m^3, determine the final volume and pressure of the system. [8M]

(OR)

2 a) How does a homogeneous system differ from a heterogeneous system? [5M]

b) 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. [9M]

UNIT - II

3 a) Explain how the first law of thermodynamics applied to a process? [7M]

b) Derive the expression for work done in Polytrophic process. [7M]

(OR)

4 a) Explain clearly the difference between a non-flow and a steady flow process. [7M]

b) 12 kg of air per minute is delivered by a centrifugal air compressor. The inlet and outlet conditions of air are C_1 = 12 m/s, p_1 = 1 bar, v_1 = 0.5 m^3/kg and C_2 = 90 m/s, p_2 = 8 bar, v_2 = 0.14 m^3/kg. The increase in enthalpy of air passing through the compressor is 150 kJ/kg and heat loss to the surroundings is 700 kJ/min. Find: (i) Motor power required to drive the compressor; (ii) Ratio of inlet to outlet pipe diameter. Assume that inlet and discharge lines are at the same level. [7M]

UNIT - III

5 a) Compare the first law and second law of thermodynamics with suitable examples? [7M]

b) Discuss the equivalence of Clausius Statement to the Kelvin-Planck Statement. [7M]

(OR)

6 a) Define Gibb's and Helmholtz's functions? Compare the importance of them? [7M]

b) Heat flows from a hot reservoir at 800K to another reservoir at 250K.If the entropy change of overall process is 4.25kJ/K, make calculation for the heat flowing out of the high temperature reservoir? [7M]

UNIT - IV

7 a) Explain with a neat diagram p-V-T surface. [7M]

b) What amount of heat would be required to produce 4.4 kg of steam at a pressure of 6 bar and temperature of 250°C from water at 30°C? Take specific heat for superheated steam as 2.2 kJ/kg K. [7M]

(OR)

8 a) Derive the Clausius Claperon equation. [7M]

b) Why can not a throttling calorimeter measure the quality, if the steam is wet? Explain how is the quality been measured? [7M]

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UNIT - V

9 a) write down the Dalton's law of partial pressure and explain its importance. [6M]

b) 0.45 kg of CO and 1 kg of air is contained in a vessel of volume 0.4 m^3 at 15^0C. Air has 23.3% of O_2 and 76.7% of N_2 by mass. Calculate the partial pressure of each constituents and total pressure in the vessel. Molar masses of CO,O_2 and N_2 are 28, 32 and 28 kg/k mol. [8M]

(OR)

10 a) Draw the psychrometric chart and show any two psychrometric processes on it. [7M]

b) A sample of moist air at 1 atm and 25^0C has a moisture content of 0.01% by volume. Determine the humidity ratio, the partial pressure of water vapour, the degree of saturation, the relative humidity and the dew point temperature. [7M]

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