Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Third Semester B.Tech Degree (S,FE) Examination December 2020 (2015 Scheme)

Course Code: ME205

Course Name: THERMODYNAMICS

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any three full questions, each carries 10 marks. Marks

1 a) Discuss the following
i) Macroscopic and Microscopic approaches in thermodynamics with suitable example. (6)
ii) Thermodynamic Equilibrium

b) Explain the Zeroth law of thermodynamics and its significance. (4)

2 a) Explain temperature scale. How can the ideal gas temperature for the steam point be measured? (4)

b) Show that work is a path function and not a property. Why does free expansion have zero work transfer? (6)

3 a) Define enthalpy. Why the enthalpy of an ideal gas does depend only on temperature? (5)

b) A gas expands from initial state where the pressure is 340 kPa and the volume is 0.0425 m^3 to a final pressure of 136 kPa. The relationship between the pressure and volume of the gas is pv^2 = c constant. Determine the work for the process. (5)

4 a) Derive the steady flow energy equation. (5)

b) Air enters a compressor operating at steady state at a pressure of 1 bar, a temperature of 290 K, and a velocity of 6 m/s through an inlet with an area of 0.1 m^2. At exit, the pressure is 7 bar, the temperature is 450 K and the velocity is 2 m/s. heat transfer from the compressor to the surroundings occurs at the rate of 180kJ/min. Employing the Ideal gas model, calculate the power input to the compressor. Take cp = 1.005 kJ/kgK. (5)

PART B

Answer any three full questions, each carries 10 marks.

5 a) State the Kelvin-Plank statement of the second Law. To produce network in a thermodynamic cycle, a heat engine has to exchange heat with two thermal reservoirs. Explain. (5)

b) Establish the equivalence of Kelvin-Planck and Clausius Statements. (5)

6 a) A refrigeration plant for a food store operates as a reversed Carnot heat engine cycle. The store is to be maintained at a temperature of – 5°C and the heat transfer from the store to the cycle is at the rate of 5 kW. If heat is transferred (6)

from the cycle to the atmosphere at a temperature of 25°C, calculate the power required to drive the plant.

b) Explain the causes of irreversibly. (4)

7 a) "Second law is also known as the law of degradation of energy", Justify. (4)

b) A volume vessel of volume 0.04 m^3 contains a mixture of saturated water and saturated steam at a temperature of 250^0C. The mass of the liquid present is 9 kg. Find the pressure, the mass, the specific volume, the enthalpy, the entropy and the internal energy. (6)

8 a) Show that the efficiency of the reversible heat engine operating between two given constant temperature is the maximum. (5)

b) Draw the phase diagram for a pure substance on h-s plot with relevant constant property line. (5)

PART C

Answer any four full questions, each carries 10 marks

9 a) Express the changes in internal energy and enthalpy of an ideal gas in a reversible adiabatic process in terms of pressure ratio. (6)

b) How does the Vander Waal's equation differ from the ideal gas equation of states? (4)

10 a) Define law of corresponding state. What is compressibility factor? (5)

b) State Dalton's law of partial pressures. How is the partial pressure in a gas mixture related to the mole fraction? (5)

11 a) Write Berthelot, Dieterici and Redlich-Kwong equation of real gas. (6)

b) State and explain Amagat's law of partial volume of gas mixture. (4)

12 Write down the first and second TdS equations, and derive the expression for the difference in heat capacities C_p and C_v. What does the expression signify? (10)

13 a) Define Joule – Thompson co-efficient. Why is it zero for an Ideal gas? (5)

b) State Helmholtz function and Gibbs function. (5)

14 a) Write short notes on enthalpy of formation and enthalpy of combustion. (5)

b) Define Isothermal compressibility and coefficient of volume expansion. (5)

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