

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 $c_p = 1.005 \text{ kJ/kgK}$. (5)

PART B*Answer any three full questions, each carries 10 marks.*

- 5 a) State the Kelvin-Planck 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

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°C . 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)
