Reg No.:_______________ Name:__________________________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

THIRD SEMESTER B.TECH DEGREE EXAMINATION(R&S), DECEMBER 2019

Course Code: ME205

Course Name: THERMODYNAMICS

(Permitted to use Steam tables and Mollier Charts)

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any three full questions, each carries10marks. Marks

1	a)	Define the following (1) Microscopic & Macroscopic View Points (2) Thermodynamic Equilibrium	(5)
	b)	Define Quasi-static Process. What are its characteristic features?	(5)
2	a)	Explain constant volume gas thermometer with neat diagram.	(5)
	b)	Distinguish between flow work and displacement work. Why does free expansion have zero work transfer?	(5)
3	a)	State the first law for a closed system undergoing a change of state. Show that energy a property of the system.	(5)
	b)	1.5 kg of liquid having a constant specific heat of 2.5kJ/kgK is stirred in a well insulated chamber causing the temperature to rise by 15^{o}C. Find change in internal energy and work done for the process.	(5)
4		Derive steady flow energy equation for a single stream entering and a single stream leaving a control volume and explain the various terms in it. Under what conditions does the steady flow energy equation reduces to Euler's equation	(10)

PART B

Answer any three full questions, each carries10marks.

5	a)	Explain two statements of second law of thermodynamics. Establish its equivalence.	(5)
	b)	A heat engine operating between two reservoirs at temperatures 600^{o}C and 40^{o}C drives a refrigerator operating between reservoirs at temperatures of 40oC and -15^{o}C. The heat transfer to the heat engine is 2500kJ and the net output of the combined engine and refrigerator plant is 400kJ. The efficiency of the heat engine and the COP of the refrigerator are each 40% of the maximum possible values. Estimate heat transfer to the refrigerant and the net heat transfer to the reservoir at 40^{o}C.	(5)

6 a) Establish the inequality of Clausius (4)

b) Determine the maximum work obtainable from two finite bodies at temperature T_1 and T_2. What are the causes of entropy increase? (6)

7 a) Derive expression for useful work for a steady flow system which interacts only with the surroundings. (5)

b) Calculate the decrease in exergy when 25 kg of water at 95^oC mix with 35 kg of water at 35^oC, the pressure being taken as constant and the temperature of the surroundings being 15^oC (c_p of water = 4.2 kJ/kg K) (5)

8 A vessel of volume 0.04 m^3 contains a mixture of saturated water and saturated steam at a temperature of 250^oC. 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 (10)

PART C

Answer any four full questions, each carries10marks.

9 a) Define the following: (5)

(1) Avogadro's Law (2) Equations of State

b) Express the changes in internal energy and enthalpy of an ideal gas in a reversible adiabatic process in terms of the pressure ratio. (5)

10 a) Define Virial Expansion. Also explain Law of corresponding state. (6)

b) Explain Van der Waals equation of state. How does it differ from the Ideal gas equation of state? (4)

11 a) State and explain Amagat's law of partial volumes of a gas mixture (5)

b) A mass of 0.25 kg of an ideal gas has a pressure of 300 kPa, a temperature of 80°C, and a volume of 0.07 m^3. The gas undergoes an irreversible adiabatic process to a final pressure of 300 kPa and final volume of $0.10m^3$, during which work done on gas is 25 kJ. Evaluate the c_p and c_v of the gas and the increase in entropy of the gas. (5)

12 a) Derive Maxwell's equation (5)

b) Define Volume expansivity and isothermal compressibility (5)

13 Explain Joule - Kelvin effect. What is the significance of inversion curve? (10)

14 a) Define adiabatic flame temperature. How is it estimated? (5)

b) Explain (1) Enthalpy of Combustion (2) Internal Energy of combustion (5)