Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

THIRD SEMESTER B.TECH DEGREE EXAMINATION(S), MAY 2019

Course Code: ME205
Course Name: THERMODYNAMICS
(Steam Tables allowed)

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any three full questions, each carries10marks.

			Marks
1	a)	Explain microscopic and macroscopic view points	(3)
	b)	Distinguish between change of state, path and process	(3)
	c)	How will you define density and pressure using the concept of continuum?	(4)
2	a)	Explain constant volume gas thermometer with a neat diagram	(3)
	b)	Why does free expansion have zero work transfer?	(3)
	c)	Define internal energy. Show that energy a property of a system	(4)
3	a)	Define specific heat and derive it for constant volume and at constant pressure	(4)
	b)	A gas of 4 kg is contained within the piston cylinder machine. The gas undergoes a process for which $pV^{1.5}$ = Constant. The initial pressure is 3 bar and the initial volume is $0.1m^3$, and the final volume is $0.2m^3$. The specific internal energy of the gas decreases by 4.6kJ/kg. There is no significant change in KE and PE. Determine net heat transfer for the process.	(6)
4	a)	How can you relate S.F.E.E with Euler and Bernoulli Equations?	(5)
	b)	A pump steadily delivers water at a volumetric flow rate of $0.05m^3/s$ through a pipe of diameter 18 cm located 100 m above the inlet pipe which has a diameter of 15 cm. The pressure is nearly equal to 1 bar at both the inlet and the exit, and the temperature is nearly constant at 20°C throughout. Determine the power required by the pump. Take g= 9.81 m/s^2	(5)

PART B

Answer any three full questions, each carries10marks.

5	a)	Establish the equivalence of Kelvin – Plank and Clausius statement	(5)
	b)	A heat pump working on the Carnot cycle takes in heat from a reservoir at 5°C and deliver heat to a reservoir at 60°C. The heat pump is driven by a reversible heat engine which takes in heat from a reservoir at 840°C and rejects heat to a reservoir at 60°C. The reversible heat engine also drives a machine that absorbs 30kW. If the heat pump extracts 17kJ/s from 5°C reservoir. Determine (a) rate of	(5)

heat supply from the 840°C source and (b) the rate of heat rejection to the 60°C sink.

6 a) Establish the Inequality of Clausius (5)

b) A fluid undergoes a reversible adiabatic compression from 0.5Mpa, $0.2m^3$ to $0.05m^3$ according to law, $pv^{1.3}$ = constant. Determine the change in enthalpy, internal energy and entropy and the heat transfer and work transfer during the process. (5)

7 a) What do you understand by exergy and anergy? (3)

b) Derive expression for useful work for a steady flow system which interact only with the surroundings (7)

8 a) What is the critical state? Draw the phase equilibrium diagram on p-v coordinates for a substance which shrinks in volume on melting. (4)

b) Steam initially at 0.3 MPa, 250°C is cooled at constant volume. (a) At what temperature will the steam become saturated vapour? (b) What is quality at 80°C? (c) What is the heat transferred per kg of steam in cooling from250°C to 80°C? (6)

PART C

Answer any four full questions, each carries10marks.

9 a) Show that enthalpy of an ideal gas is a function of temperature only (4)

b) Express Van der Waals equation of state in the virial form and find the Boyle temperature (6)

10 a) Explain different properties of real gas mixtures and the laws associated. (10)

11 a) Show that in a diffusion process a gas undergoes a free expansion from the total pressure to the relevant partial pressure. (10)

12 a) Derive Maxwell relations from relevant equations of the form dz=Mdx+Ndy. (10)
Also derive Clausius-Clapeyron equation from Maxwell relation.

13 a) Explain how enthalpy change and entropy change of a gas are estimated from an equation of state. (10)

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

b) Explain enthalpy of combustion. (5)

****