JYOTHI ENGG. COLLEGE LIBRARY
THRISSUR EDUCATIONAL TRUST
CHERUTHURUTHY
13/1/26

Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S4 (S,FE) Examination January 2026 (2019 Scheme)

Course Code: MRT202

Course Name: THERMODYNAMICS

(Permitted to use Steam Tables and Mollier charts)

Max. Marks: 100 Duration: 3 Hours

PART A

(Answer all questions; each question carries 3 marks)

		Marks
1	What are the three conditions for thermodynamic equilibrium?	3
2	What you mean by an extensive property. Give an example	3
3	Give the comparison between work and heat.	3
4	Explain work done in the case of free expansion with a suitable example.	3
5	Discuss the concept of the principle of increase in entropy	3
6	Derive the relationship between COP of refrigerator and COP of heat pump.	3
7	What you meant by dryness fraction.	3
8	Write and explain the Van der Waals Equation of state.	3
9	Define Gibbs function and state their significance	3
10	Explain Kay's rule of real gas mixtures	3

PART B

(Answer one full question from each module, each question carries 14 marks)

Module -1

11	a)	Explain the concept of continuum	7
	b)	The temperature (T) on a thermometric scale is defined in terms of a property K by the relation $T = a \ln K + b$, where a and b are constants. The values of K are found to be 1.8 and 6.5 at the ice point and the steam point, the temperatures of which are assigned the numbers 0 and 100 respectively. Determine the temperature corresponding to a reading of K equal to 2.8 on the thermometer.	7
12	a)	Differentiate point function and path function with suitable examples	7
	b)	Explain the Zeroth law of thermodynamics and discuss the temperature	7

measurement method used before 1954.

Module -2

13 a) A piston-cylinder device with air at an initial temperature of 30° C undergoes an expansion process for which pressure and volume are related as given below: 7

P(kPa)	100	37.9	14.4
V (m3)	0.1	0.2	0.4

Calculate the work done by the system.

b) State first law of thermodynamics for closed system undergoing a change of state and show that energy a property of system. 7

14 a) Derive the Steady Flow Energy Equation (SFEE) applied to a Turbine 7

b) In a steady flow apparatus, 125 kJ of work is done by each kg of fluid. The specific volume of fluid, pressure, and velocity at inlet are 0.35 m^3/kg, 600 kPa and 15 m/s. The inlet is 32 m above floor and discharge pipe is at floor level. The discharge conditions are 0.60 m^3/kg, 100 kPa and 275 m/s. The total heat loss between inlet and discharge is 10 kJ/kg. In flowing through this apparatus, what will be the change in specific internal energy? 7

Module -3

15 a) A cyclic heat engine operates between a source temperature of 900 °C and a sink temperature of 40 °C. What is the least rate of heat rejection per kW net-work output of the engine? 7

b) 1 kg of water at 273 K is brought into contact with a heat reservoir at 373 K. When the water has reached 373 K, find the entropy change of the water of the heat reservoir and of the universe. 7

16 A) Derive the Clausius inequality equation and write the criterion for reversible cycle, irreversible cycle and impossible cycle 7

b) Derive the expression for the entropy change for a closed system. 7

Module -4

17 a) Explain the P-v diagram of pure substance that contract during freezing. Explain the concept of triple point and write down the pressure, temperature and specific volume corresponds to triple point of water. 7

b) Steam initially at 0.3 MPa, 250°C is cooled at constant volume. (i) At what 7

temperature will steam become saturated vapour? (ii) What is the dryness fraction at 80°C? (iii) What is the heat transferred per kg of steam in cooling from 250°C to 80°C.

18 a) Explain and discuss the significance of Virial equations of state. 7

b) What are the reasons for deviation of real gas behaviour form ideal gas behaviour? Discuss the need for compressibility factor and compressibility chart 7

Module -5

19 a) The ratio of specific heats (γ) for acetylene (C_2H_2) is found to be 1.26. Find c_p and c_v for acetylene. 7

b) Derive the expressions for the equivalent molecular weight and characteristic gas constant for an ideal gas mixture. 7

20 a) Derive the Tds Equations using Maxwell relations and and explain its significance 7

b) Derive Clapeyron Equation for evaporation of liquids. Explain the significance of Clapeyron Equation using p-T diagram. 7

***