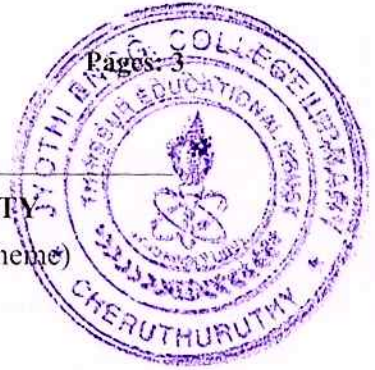


Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
B.Tech Degree S4 (R) (FT/WP) Examinations April 2026 (2024 Scheme)



Course Code: PCMET403

Course Name: ENGINEERING THERMODYNAMICS

Max. Marks: 60

Duration: 2hours30minutes

(Use of Steam tables and Mollier chart are permitted)

PART A

(Answer all questions. Each question carries 3 marks)

		CO	Marks
1	Distinguish between macroscopic and microscopic viewpoints in thermodynamics	1	(3)
2	What is total energy? Identify the different forms of energy that constitute the total energy.	1	(3)
3	State the First Law of Thermodynamics for a closed system.	2	(3)
4	Draw the schematic diagram of a heat engine and Refrigerator and define thermal efficiency and COP	2	(3)
5	Why is PMM2 impossible according to the Second Law?	2	(3)
6	Define second-law efficiency. How does it differ from first-law efficiency?	3	(3)
7	Define (i) critical point (ii) Dryness fraction (iii) saturation state	5	(3)
8	Draw the P-T diagram for a pure substance that expands on freezing. Show all the phase change process lines, critical point and triple point in the above diagram.	5	(3)

PART B

(Answer any one full question from each module, each question carries 9 marks)

Module -1

9	a) Differentiate the following with examples (i) System and control volume (ii) Intensive and extensive properties	1	(4)
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- b) What is thermodynamic equilibrium? Explain the three conditions to be satisfied by the system to attain thermodynamic equilibrium 1 (5)
- 10 a) Define path function. Why heat and work are considered path functions? 1 (4)
- b) State and explain Zeroth law of thermodynamics. Give examples of two point and single point thermometry by stating the name of the temperature scale and the reference points used in it 1 (5)

Module -2

- 11 a) Define enthalpy and prove that enthalpy of an ideal gas is a function of temperature only 2 (3)
- b) A mass of 8kg gas expands within a flexible container so that the p-v relationship is of the form $pv^{1.2} = \text{constant}$. The initial pressure is 1000kPa and the initial volume is 1m^3 . The final pressure is 5kPa. If the specific internal energy of the gas decreases by 40kJ/kg, find the heat transfer in magnitude and direction. 3 (6)
- 12 a) In a gas turbine the gas enters at the rate of 5kg/s with a velocity of 50m/s and enthalpy of 900kJ/kg and leaves the turbine with a velocity of 150m/s and enthalpy of 400kJ/kg. The loss of heat from the gases to the surroundings is 25kJ/kg. Assume for gas $R = 0.285\text{kJ/kg K}$ and $C_p = 1.004\text{kJ/kg K}$ and the inlet conditions to be at 100kPa and 27°C . Determine the power output of the turbine and the diameter of the inlet pipe. 3 (9)

Module -3

- 13 a) Show that the Kelvin–Planck and Clausius statements are equivalent. 2 (5)
- b) A cyclic heat engine operates between a source temperature of 800°C and sink temperature of 30°C . What is the least rate of heat rejection per kW net output of the engine 3 (4)
- 14 a) An adiabatic vessel contains 3 kg of water at 30°C . By paddle – wheel work transfer, the temperature of water is increased to 36°C . If the specific heat of water is assumed to be constant at 4.2 kJ/kg K , find the entropy change of the universe 4 (9)

Module -4

- 15 a) Define isentropic efficiency of turbine and nozzle. Explain using h-s diagram. 4 (5)
- b) Write the ideal gas equation of state and the Vander Waals equation. Explain the correction factors used in Vander Waals Equation. 5 (4)
- 16 a) Steam at 20 bar and 350°C expands isentropically to 1 bar. Calculate the change in enthalpy, volume and temperature of unit mass of steam during this process using steam tables. 5 (9)
