Name: **Enrolment No:**	

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2023

Course: Engineering Thermodynamics **Semester: III**
Program: B.Tech Mechatronics and ADE **Time : 03 hrs.**
Course Code: MECH2014 **Max. Marks: 100**

Instructions: Make suitable assumptions (if any needed)

SECTION A
(5Qx4M=20Marks)

S. No.	Question	Marks	CO
Q 1	Why the word "thermodynamics" is a misnomer? Explain.	**4**	**CO1**
Q 2	Elaborate the Microscopic approach and the concept of continuum.	**4**	**CO1**
Q 3	Explain the following (a) PMM1 and (b) PMM2.	**4**	**CO1**
Q 4	Is entropy a property of the system? Explain.	**4**	**CO1**
Q 5	State the third law of thermodynamics and its importance,	**4**	**CO1**
	SECTION B **(4Qx10M= 40 Marks)**		
Q 6	Establish the equivalence of Kelvin Planck and Clausius statements?	**10**	**CO2**
Q 7	A gas flows steadily through a compressor. The gas enters the compressor at a temperature of 16°C, a pressure of 100 kPa, and an enthalpy of 390 kJ/kg. The gas leaves the compressor at a temperature of 255°C, a pressure of 0.5 MPa, and an enthalpy of 500 kJ/kg. There is no heat transfer to or from the gas as it flows through the compressor. (a) Evaluate the external work done per unit mass of gas assuming the gas velocities at entry and exit to be negligible. (b) Evaluate the external work done per unit mass of gas when the gas velocity at entry is 100 m/s and that at exit is 150 m/s.	**10**	**CO3**
Q 8	Two reversible heat engines *A* and *B* are arranged in series, A rejecting heat directly to *B.* Engine *A* receive 100 kJ at a temperature of 300°C from a hot source, while engine *B* is in communication with a cold sink at a temperature of 8°C. If the work output of *A* is twice that of *B,* find (a) The intermediate temperature between *A* and *B;* (b) The efficiency of each engine; (c) The heat rejected to the cold sink.	**10**	**CO3**

Q 9	Dry saturated steam at a enthalpy of 500 kJ/kg is expanded isentropically in a Turbine to an enthalpy of 300 kJ/kg. the exit velocity of steam is 56 m/s Find the work done by the steam on the turbine. **OR** 5 kg of oil at 50°C are mixed adiabatically with 3 kg of oil at 30°C in a constant pressure process of 1 atmosphere. Find the increase in the entropy of the total mass of oil due to the mixing process (*Cp* of oil = 4.5 kJ/kg K).	**10**	**CO4**
SECTION-C **(2Qx20M=40 Marks)**			
Q 10	(a) Drive the Steady Flow Energy Equation on per unit mass basis. (b) Calculate the entropy change of the universe as a result of the following processes: (a) A Aluminium block of 300 g mass and with *Cp* of 110 J/K at 100°C is placed in a lake at 4°C. (b) The same block, at 4°C, is dropped from a height of 100 m into the lake.	**20**	**CO4**
Q 11	(a) Drive the relation for the Air Standard efficiency of Diesel Cycle. (b) A domestic refriferator is loaded with food and the door closed, During a certain period the machine consumes 2 kWh of energy and the internal energy of the system drops by 5500 kJ. Find the net heat transfer for the system. OR (a) Show that the efficiency of the Otto cycle depends only on the compression ratio. (b) In an Air standard Otto, cycle the compression ratio is 6, and the compression begins at 30°C, 0.11 MPa, the maximum temperature of the cycle is 1500°C. Find (a) the temperature and pressure at the cardinal points of the cycle, (b) the heat supplied per kg of air, (c) the work done per kg of air (d) the cycle efficiency, and (e) the mean effective pressure of the cycle.	**20**	**CO2**