Name: **Enrolment No:**	

UPES

Supplementary- Examination, December 2023

Course: Thermodynamics and Heat Engines **Semester : III**

Program: B. Tech- Automotive Design Engineering **Time : 03 hrs.**

Course Code: MEPD2006 **Max. Marks: 100**

Instructions: Use of STEAM TABLE is permitted.

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	Explain the Zeroth law of thermodynamics and state the practical application of the law in day to day life.	**4**	**CO1**
Q 2	Discuss the 'Concept of Continuum' and its relevance in study of thermodynamics.	**4**	**CO1**
Q 3	What do you mean by thermodynamic equilibrium?	**4**	**CO1**
Q 4	Define entropy. What are the causes of entropy increases?	**4**	**CO2**
Q 5	Differentiate between petrol and Diesel engine giving five differences.	**4**	**CO4**

SECTION B
(4Qx10M= 40 Marks)

Q 6	With the help of pressure- volume diagram, explain the working of an Air standard Otto cycle. List the assumption made in the cycle.	**10**	**CO2**
Q 7	Explain the working of 4-Stroke Diesel engine with the help of suitable diagram.	**10**	**CO2**
Q 8	A steam turbine under steady flow conditions as it receives steam with an enthalpy 3240 kJ/kg, velocity 35 m/s and elevation 4 m. The outlet of steam from the turbine has enthalpy of 2450 kJ/kg, velocity 125 m/s, and elevation 1 m. In the entire process the heat lost takes place at the rate of 0.25 kJ/s. Determine the power output of the turbine in kW for a constant flow rate of 0.42 kg/s through turbine.	**10**	**CO4**
Q 9	Ten kg of water at 45°C is heated at a constant pressure of 10 bar until it becomes superheated vapour at 300 °C. Find the change in volume, enthalpy, internal energy and entropy. **OR**	**10**	**CO4**

	4 Kg of steam at 6.0 bar pressure and dryness fraction of 0.5 is heated, so that it becomes (a) 0.95 dry (b) Dry & saturated (c) Superheated to 300 ^{o}C. Determine the net heat supplied in each case.		
SECTION-C (2Qx20M=40 Marks)			
Q 10	The compression ratio of an engine working an Otto cycle is 8. The initial condition of air are 1 bar and 373 K. The maximum pressure of a cycle is limited to 50 bar. Determine the volume, pressure and temperature at all salient points of the cycle considering 1 kg of air. Determine the work done and efficiency of the cycle for 10 kg of working fluid.	**20**	**CO3**
Q 11	In a Diesel cycle, the pressure and temperature at the beginning of compression are 1 bar and 350 K. The compression ratio is 14. Determine a. The maximum pressure attained in the cycle. b. The percentage of working stroke at which the heat supply ceases. c. Heat supplied per kg of air. **OR** A spark-ignition engine working on ideal Otto cycle has the compression ratio 6. The initial pressure and temperature of air are 1 bar and 37 °C. The maximum pressure in the cycle is 30 bar. For unit mass flow, calculate (i) p, V and T at various salient points of the cycle (ii) the ratio of heat supplied to the heat rejected and (iii) net work done by the cycle. Assume $\gamma = 1.4$.	**20**	**CO3**