Name: **Enrolment No:**	

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

Supplementary Examination, December 2023

Programme Name: B.Tech (APE Upstream) **Semester :** III
Course Name : Thermodynamics & Phase Behavior **Duration :** 3 h
Course Code : MEPD2007 **Max. Marks:** 100
Nos. of page(s) : 02

Instructions: In case of data missing make necessary assumptions

S.No.	**Section A** (Attempt all questions)	Marks	CO
Q 1	Attempt the following: (a) Differentiate state and path functions (b) Write the statement of second law of thermodynamics (c) Prove that $C_P - C_V = R$ for an ideal gas (d) What is a thermodynamic cycle	10 M	CO1
Q 2	Derive the work done for the following processes: i) Isobaric process ii) Isothermal process iii) Polytropic process	10 M	CO1
Q 3	A gas undergoes a thermodynamic cycle consisting of three processes beginning at an initial state where p_1=1 bar, V_1=1.5 m^3, and U_1=512 kJ. The processes are as follows: (i) Process 1-2: Compression with pV= constant to p_2=2 bar, U_2=690 kJ (ii) Process 2-3: W_{23}=0, Q_{23}= -150 kJ Process 3-1: W_{31}=+50 kJ. Neglecting KE and PE changes, determine the heat interactions Q_{12} and Q_{31}.	10 M	CO2
Q 4	Derive the law of conservation of energy using first law of thermodynamics for open system.	10 M	CO2
Q 5	Describe the working principle of Throttling Colorimeter for measurement of quality of Steam with neat diagram.	10 M	CO3
Q 6	Explain the working of four stroke and two stroke petrol engine with neat diagram.	10 M	CO4

	Section B (Attempt all questions)		
Q 7	(a) Explain the phase change of a pure substance with P-V, and P-T diagram. (b) For liquid acetone at 20°C and 1 bar, $\beta = 1.487 \times 10^{-3}$ °C^{-1}, $k = 62 \times 10^{-6}$ bar^{-1}, $V = 1.287$ cm^3·g^{-1}. For acetone, find: i) The value of $(\partial P / \partial T)_V$ at 20°C and 1 bar. ii) The pressure after heating at constant V from 20°C and 1 bar to 30°C. iii) The volume change when T and P go from 20°C and 1 bar to 0°C and 10 bar.	20 M	CO3
Q 8	Describe Diesel cycle in detail and derive an expression for the efficiency of a Diesel cycle. Also explain which cycle is most efficient among Otto and Diesel cycles for same compression ratio and heat rejection.	20 M	CO4