PVP 23

Code: 23ES1302

II B.Tech - I Semester – Regular Examinations - DECEMBER 2024

THERMODYNAMICS
(MECHANICAL ENGINEERING)

Duration: 3 hours Max. Marks: 70

Note: 1. This question paper contains two Parts A and B.
2. Part-A contains 10 short answer questions. Each Question carries 2 Marks.
3. Part-B contains 5 essay questions with an internal choice from each unit. Each Question carries 10 marks.
4. All parts of Question paper must be answered in one place.

BL – Blooms Level CO – Course Outcome

PART – A

		BL	CO
1.a)	Define System and process.	L1	CO1
1.b)	State difference between macroscopic and microscopic viewpoints.	L1	CO1
1.c)	State the Zeroth Law of Thermodynamics.	L1	CO2
1.d)	Define enthalpy in thermodynamics.	L2	CO2
1.e)	State the Kelvin-Planck statement of the Second Law of Thermodynamics.	L1	CO3
1.f)	Define entropy in thermodynamics.	L2	CO3
1.g)	Give an example of a phase transformation process.	L2	CO4
1.h)	State the Clausius-Clapeyron equation.	L1	CO4
1.i)	What is the main difference between the Otto cycle and the Diesel cycle?	L2	CO5
1.j)	Define the Coefficient of Performance (COP) in refrigeration systems.	L1	CO5

PART – B

			BL	CO	Max. Marks
UNIT-I					
2	a)	Explain about Quasi static process.	L2	CO1	5 M
	b)	A mass of 2.5 kg of air is compressed in a quasi-static process from 0.1 MPa to 0.7 MPa for which PV Constant. The initial volume is 0.8 m^3/kg. Find the work done by the piston to compress the air.	L2	CO1	5 M
OR					
3	a)	Explain about thermodynamic equilibrium.	L2	CO1	5 M
	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 1.83 and 6.78 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 2.42 on the thermometer.	L3	CO1	5 M
UNIT-II					
4	3Kg of air at a pressure of 150KPa and temperature 360K is compressed polytropically to 750KPa according to law $PV^{1.2}=C$. The gas is then cooled to initial temperature at constant pressure. The air is then expanded at constant temperature till it		L3	CO2	10 M

		reaches original pressure of 150KPa. Draw the cycle on P-V diagram and determine the network and heat transfer.			
OR					
5	a)	Explain the Steady Flow Energy Equation and its application in analyzing steady-state flow processes.	L2	CO2	5 M
	b)	A Centrifugal pump delivers 50kg of water per second. The inlet and outlet pressures are 1 bar and 4.2 bar respectively. The suction is 2.2m below the center of the pump and delivery is 8.5m above the center of the pump. The suction and delivery pipe diameters are 20cm and 10cm receptively. Determine the capacity of electric motor to run the pump.	L3	CO2	5 M
UNIT-III					
6		A heat engine operates between two reservoirs at temperatures of 500 K and 300 K. The engine absorbs 600 kJ of heat from the hot reservoir. Calculate: a) The efficiency of the heat engine. b) The amount of heat rejected to the cold reservoir. Discuss how the efficiency relates to the Kelvin-Planck and Clausius statements.	L3	CO3	10 M
OR					
7		Describe the Carnot cycle and explain its four distinct processes. Discuss the significance of the Carnot cycle in thermodynamics and why it is considered the most efficient cycle.	L2	CO3	10 M

UNIT-IV					
8	a)	Steam pressure is 10 bar, Calculate the Enthalpy and Entropy of the Steam. i) If the Steam is dry. ii) If the Steam is 90% dry.	L3	CO4	5 M
	b)	Briefly explain the P-V-T diagram.	L2	CO4	5 M
OR					
9	a)	A substance undergoes a phase transformation from liquid to vapor at a constant pressure. At this pressure, the boiling point is 100°C. The critical temperature of the substance is 150°C. Calculate the heat.	L3	CO4	5 M
	b)	Using a Mollier chart, determine the following for steam at 4 bar: i. Specific enthalpy (h) ii. Specific entropy (s) iii. Quality (dryness fraction) if the steam is in the saturated state.	L3	CO4	5 M
UNIT-V					
10	Compare and contrast the Otto, Diesel and Dual Combustion cycles in terms of their thermodynamic processes, P-V and T-S diagrams and thermal efficiency.		L2	CO5	10 M
OR					
11	Explain the working of the Vapor Compression Refrigeration (VCR) system with the help of a labeled diagram. Discuss the factors affecting the Coefficient of Performance (COP) and how different refrigerants impact system performance.		L2	CO5	10 M