

Paper Id: 140321

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## 5. Attempt any one part of the following:

1 x 10 = 10

Q no.	Question	Marks	CO
a.	Discuss the Clapeyron equation and also explain the Joule-Kelvin effect with help of inversion curve and inversion temperature.	10	2
b.	Heat is supplied reversibly from a heat source to a reversible engine and during this process, the temperature of the working fluid increases from 525K to 875K. Taking water equivalent as 100kJ/K and presuming that heat rejection during the cycle takes place at ambient temperature of 290K, determine the total heat abstracted, availability and the loss of available work.	10	2

## 6. Attempt any one part of the following:

1 x 10 = 10

Q no.	Question	Marks	CO
a.	A steam turbine working on a Rankine cycle is supplied with dry saturated steam at 25 bar and the exhaust takes place at 0.2 bar. For a steam flow rate of 10 kg/s, determine: i) Quality of steam at the end of expansion, ii) Turbine shaft work, iii) Power required to drive the pump, iv) Work ratio, v) Rankine efficiency, and vi) Heat flow in the condenser.	10	3
b.	Define and explain the following terms: i) Dry bulb temperature, wet bulb temperature and dew point temperature. ii) Relative humidity and specific humidity	10	3

## 7. Attempt any one part of the following:

1 x 10 = 10

Q no.	Question	Marks	CO
a.	Explain the vapour compression refrigeration cycle and find out its C.O.P. with the help of T-S, P-H, and flow diagram. Can this cycle be reversible? If not, why?	10	4
b.	The air supplied to an air-conditioned room is noted to be at temperature 20 degree Celsius and specific humidity 0.0085. Corresponding to these conditions, determine the partial pressure of vapour, relative humidity and dew point temperature. Take barometric or total pressure = 1.0132 bar.	10	4

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## SECTION C

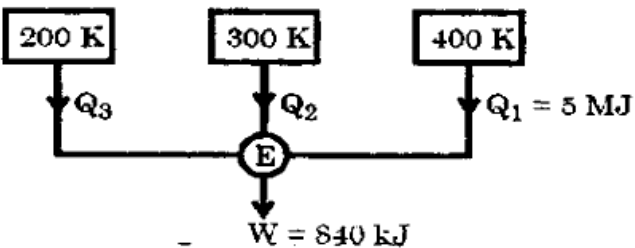
## 3. Attempt any one part of the following:

1 x 10 = 10

Q no.	Question	Marks	CO
a.	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 <sup>3</sup> and $U_1 = 512$ kJ. The processes are as follows: (i) Process 1-2: Compression with $pV = \text{constant}$ to $p_2 = 2$ bar, $U_2 = 690$ kJ (ii) Process 2-3: $W_{23} = 0$ , $Q_{23} = -150$ kJ, and (iii) Process 3-1: $W_{31} = +50$ kJ. Neglecting KE and PE changes, Determine the heat interactions $Q_{12}$ and $Q_{31}$ .	10	1
b.	A turbine operates under steady flow conditions, receiving steam at the following state: Pressure 1.2 MPa, temperature 188°C, enthalpy 2785 kJ/kg, velocity 33.3 m/s and elevation 3 m. The steam leaves the turbine at the following state: Pressure 20 kPa, enthalpy 2512 kJ/kg, velocity 100 m/s, and elevation 0 m. Heat is lost to the surroundings at the rate of 0.29 kJ/s. If the rate of steam flow through the turbine is 0.42 kg/s, what is the power output of the turbine in kW?	10	1

## 4. Attempt any one part of the following:

1 x 10 = 10

Q no.	Question	Marks	CO
a.	In a Carnot cycle, heat is supplied at 350°C and rejected at 27°C. The working fluid is water which, while receiving heat, evaporates from Liquid at 350°C to steam at 350°C. The associated entropy change is 1.44 kJ/kg K. (a) If the cycle operates on a stationary mass of 1 kg of water, how much is the work done per cycle, and how much is the heat supplied? (b) If the cycle operates in steady flow with a power output of 20 kW, What is the steam flow rate?  	10	2
b.	Establish the equivalence of Kelvin Plank and Clausius Statement. Show that efficiency of a reversible heat engine operating between the same temperature limits is same.	10	2