Sub Code: R2321031 **R23** **Set No. 1**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY-GURUJADA VIZINAGARAM
II B. Tech I Semester Regular Examinations, November – 2024
THERMODYNAMICS
(ME)

Time: 3 hours **Max. Marks: 70**

Question paper consists of Part A, Part B.
Part A is compulsory, Answer all questions.
In Part B, Answer any one question from each unit.

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PART-A **(20 Marks)**

1	a)	What is meant by isolated system	[2]
	b)	Mention the difference between the process and path	[2]
	c)	Why PMM-I called as an impossible machine	[2]
	d)	State the zeroth law of thermodynamics	[2]
	e)	What is the importance of Gibbs function	[2]
	f)	Interpret the Clausius statement of second law thermodynamics	[2]
	g)	Give some examples and applications for the pure systems	[2]
	h)	Define the latent heat of vaporization	[2]
	i)	What is meant by Tonne of refrigeration	[2]
	j)	Define dry bulb temperature and specific humidity	[2]

PART-B **(50 Marks)**

Unit-1

2	a)	What is Quasi-static static process. Explain it with neat sketch	[5]
	b)	State the reasons for the process to be irreversible with the examples	[5]

(OR)

3	a)	Explain the different types of process takes place in the universe. Explain the characteristics of boundary and control volume.	[5]
	b)	List out the differences between the (i) Macroscopic approach and microscopic approach (ii) Closed system and Open system	[5]

Unit-2

4	a)	Explain about the concept of energy in transition.	[3]
	b)	A piston and cylinder machine contain a fluid system which passes through a complete cycle of four processes. During a cycle the sum of all heat transfer is -170 KJ. The system completes 100 cycles per min. Complete the following table showing the method for each item, and computes the net rate of work output in KW.	[7]

Process	Heat transfer in KJ/min	Work done in KJ/min	Change in internal energy KJ/min
1-2	0	2170	-
2-3	21,000	0	-
3-4	-2,100	-	-36,600
4-1	-	-	-

(OR)

5 a) A thermodynamic system operates under steady flow conditions, the fluid entering at 2 bar and leaving at 10 bar. The entry velocity is 30 m/s and the exit velocity is 10m/s. During the process 25 MJ/hr of heat from an external source is supplied and the increase in enthalpy is 5kJ/kg. The exit point is 20m above the entry point. Estimate flow work from the system if the fluid flow rate is 15 kg/min. [5]

b) Explain the working of heat pump with neat sketch [5]

Unit-3

6 a) Show the equivalence of Kelvin -Plank statement and Clausius statements of second law of thermodynamics with neat sketch [5]

b) A refrigeration plant for a food store operates as a reversed Carnot heat engine cycle. The store is to be maintained at a temperature of -5○C and the heat transfer from the store to the cycle is at the rate of 5KW. If heat is transferred from the cycle to the atmosphere at a temperature of 25°C calculate the power required to drive the plant. [5]

(OR)

7 Calculate the entropy change of the universe as a result of the following processes: i) A copper block of 600 g mass and with Cp of 150 J/K at 100°C is place in a lake at 8°C. ii) The same block at 8°C is dropped from a height of 100 m into the lake. iii) Two such blocks at 100 and 0°C are joined together. [10]

Unit-4

8 a) Explain the process of formation of steam with T-s diagram. [5]

b) 3 kg of steam at 18 bar occupy a volume of 0.2550 m^3 . During a constant volume process, the heat rejected is 1320 kJ. Determine final internal energy also find initial dryness and work done. [5]

(OR)

9 a) A rigid closed tank of volume 3 m^3 contains 5kg of wet steam at a pressure of 200 KPa. The tank is heated until the steam become dry saturated. Determine the final pressure and the heat transfer to the tank. [5]

b) Derive the Clausius Clapeyron equation to find out the heat of vaporization of the steam [5]

Unit-5

10 An air refrigerant works between the pressure limits of 1 bar and 5 bar. The temperature of the air entering the compressor and expansion cylinder are 100C and 250C respectively. The expansion and compression follow the law pv1.3 =Constant, Find the following. [10]

1.The COP of the refrigerant cycle.

2.If the load on the refrigerating machine is 10 TR, find the amount of air circulated per minute through the system assuming that actual COP is 50% of the theoretical COP

3. The stroke length and piston diameter of single acting compressor if the compressor runs at 300 rpm and volumetric efficiency is 85%

Take L/d= 1.5 ; C_p =1.005kJ/kg K ; Cv =0.71 kJ/kg K

(OR)

11 The atmospheric air at 750 mm of Hg has 34^0C dry bulb temperature and 19^0C wet bulb temperature. Using Psychrometric char, find (a) Partial pressure of vapour [10]

(b) Saturation pressure corresponding to 34^0C and (c) volume of air per kg of dry air

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