VIT
Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

Continuous Assessment Test – II

Programme Name & Branch: B.Tech. (BEM/BME/BMA)

Course Name & Code: Engineering Thermodynamics (MEE1003)

Class Number: VL2019201001819 Slot: A2+TA2+V3 Exam Duration: 90 Mins. Max. Marks: 50

General instruction(s):

1. Missing data, if any, may suitably be assumed.

2. Use of steam tables and Mollier chart permitted

Answer All the Questions

S. No.	Question
1 a.	Assume a Carnot engine works between the sun and earth temperatures. Find its efficiency. Is this 100%? If not, explain why it is less than 100%. Assume the temperatures suitably. [4 Marks]
1 b.	Explain why the states 2 and 3 are marked at same locations in the p T diagram shown in Fig. 1

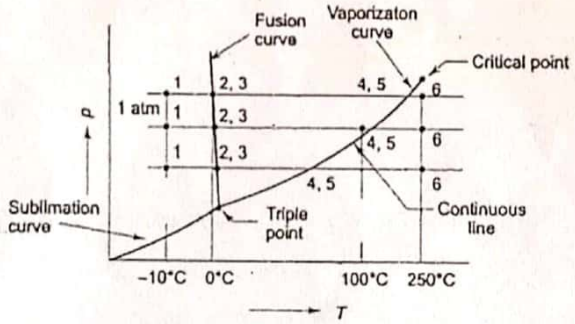

Fig.1

[3 Marks]

1 c. What is the second law efficiency of the following system shown in Fig.2? Explain.

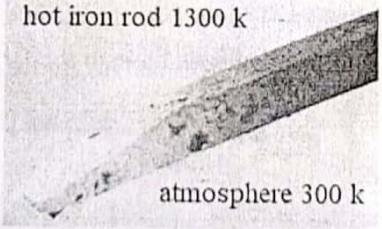

Fig. 2

[3 Marks]

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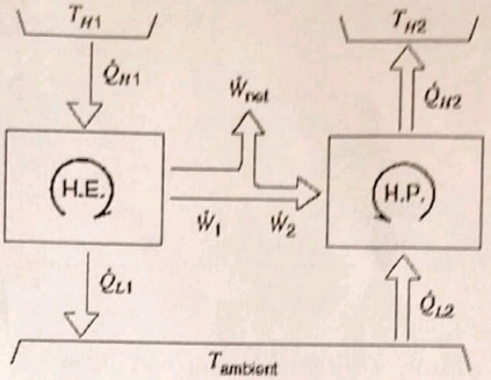
2. Consider a heat engine and heat pump connected as shown in Fig.3. Assume $T_{H1} = T_{H2} > T_{amb}$ and determine for each of the three cases if the setup satisfy the first law and / or violates the second law. (hint: assume H.E and H.P together a system)



	$\dot{Q}_{H1}$	$\dot{Q}_{L1}$	$\dot{W}_1$	$\dot{Q}_{H2}$	$\dot{Q}_{L2}$	$\dot{W}_2$
a	6	4	2	3	2	1
b	6	4	2	5	4	1
c	3	2	1	4	3	1

Fig. 3

[15 Marks]

3. Steam enters the turbine of a Rankine cycle with a temperature of 600°C and specific entropy of 7 kJ/kgK. Saturated liquid exits the condenser at a saturation temperature of 60°C. The net power output of the cycle is 10 MW. **Draw the cycle in the given ph chart.** Determine (a) the boiler pressure (b) the condenser pressure (c) condition of steam entering the turbine (d) heat added in the boiler (e) the turbine work (f) heat rejected in the condenser (g) the thermal efficiency, (h) Maximum possible thermal efficiency (i) the mass flow rate of steam, in kg/s (j) dryness fraction of steam leaving the turbine. Neglect pump work **(Use the given ph chart only and attach the chart with the answer sheet)**

[15 Marks]

4. Derive the following relation for a reversible isothermal process.

$S_2 - S_1 = mC_v(\gamma - 1)\ln(P_1/P_2)$

[10 Marks]

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