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MET 350 Thermal Applications CRN 33464

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Test 2 Reflections

Question 1

1)

For Test 1 Question 1, I was successful in demonstrating my understanding of thermodynamic principles within a Rankine cycle as well as the effects of various steam trap malfunctions on the overall system performance. My understanding of these systems is exemplified in my ability to calculate, and then recalculate mass fractions, temperature change, and thermal efficiency.

I was satisfied to see that my P-V and T-S diagrams were correct because I had a small struggle with them at the beginning of the module which required review. I believe that this demonstrates a better knowledge of the Rankine cycles and how to identify key parameters for the problem. Also, I was pleased to see that my procedure for addressing the problem mirrored Dr. Ayala's solution.

2)

However, my major failing within the question was that I calculated "z" differently than the "y". I believed that "z" should have the other system components incorporated, so I stated that $z = ((h_1 - h_3) + y * (h_8 - h_{11})) / (h_6 - h_{10})$, but I see now that Dr. Ayala simplified the problem by utilizing $z = (h_3 - h_2) / (h_{10} - h_{14})$.

For Part B the last two answers for Question 1, my procedure was mostly correct, except for the calculation for the change in temperature. I believed that the "w" value needed to be derived as well, but I see here again that Dr. Ayala stated $\Delta t = m_t / m_w$ and in this comparison one does not need the "w" factor.

In summary, my major difference from Dr. Ayala's work was that my calculation for "z" should be simplified and that my calculation for "w" was unnecessary. For next time, I would consider potential failure scenarios differently, going beyond just the given steam trap malfunction. In other words, I would not focus on the difference in the problem's scenario and instead treat it like the ideal scenarios from the module's homework.

3)

From Problem Solution Rubric and Email Rubric;

PROBLEM 1)

1. P-v and T-s diagrams

1/10 out of 1/10

Grade: 1 / 1

Explanation: The provided P-V and T-S Diagrams were accurate with the question.

2. Realize that some states are not needed

1/10 out of 1/10

Grade: 0.25 / 1

Explanation: The calculation for "z" was correct, but I calculated "w" which was unnecessary.

3. State calculations (at least 11 of them)

2/10 out of 2/10

Grade: 2 / 2

Explanation: The overall strategy Meets Standard and demonstrates an understanding of the concepts from Chapter 10. However, errors with the state equations

4. Calculate "y" and get $y = 0$

1/10 out of 1/10

Grade: 0.75 / 1

Explanation: the calculation Meets Standard, but I did not specifically identify that " $y = 0$ " must happen for proper pump operation within the cycle

5. Calculate "z"

1/10 out of 1/10

Grade: 0.5 / 1

Explanation: The diagrams and problem solving strategy demonstrate an understanding of the course objectives but the calculation for "z" was erroneous

6. Calculate ΔT water

1/10 out of 1/10

Grade: 1 / 1

Explanation: The answer meets standards as is was within an acceptable margin of error for calculation differences (10.59 vs 10.50)

7. Thermal efficiency (W_{net} & Q_{in})

2/10 out of 2/10

Grade: 1.75 / 2

Explanation: The answer meets standards as is was within an acceptable margin of error for calculation differences (42.2% vs 41.2%)

8. Final results

1/10 out of 1/10

Grade: 0.75 / 1

Explanation: The final results were within a reasonable margin of error, but mistakes when calculating "z", "w", and " Δt " were noted.

4)

a). One of the main issues I encountered was correctly applying the energy balance equations, especially when determining the mass extraction fractions for the feedwater heaters.

b). To complete the test, I first focused on identifying all the given variables. Then, I outlined the equations needed for mass fraction calculations, heat transfer analysis, and efficiency determination.

c). In this portion, gained a deeper understanding of how feedwater heaters impact the efficiency of a Rankine cycle and how a malfunctioning steam trap affects mass flow distribution

d). In my work as an Engineering Technician for the Mack Truck production plant in Salem, VA, I can imagine that these concepts are heavily utilized for plant engineering, particularly in thermal power plants where Rankine cycles are implemented.

e). I anticipate using these concepts in any field related to power generation or energy management. I work in a facility that utilizes HVAC systems, industrial boilers, and renewable energy systems with thermal storage

f). Yes, I believe that understanding Rankine cycles and thermodynamic efficiency is crucial for anyone working in power generation, or energy management

g). I believe that I will utilize these concepts in the future if I choose to work troubleshooting performance issues in steam-based systems or designing heat exchangers

h). Yes, I see connections to other courses, particularly those dealing with heat transfer and fluid mechanics.

i). I believe that I was most successful in my problem solving strategy. Particularly in setting up the equations correctly and understanding the overall impact of mass extraction on system performance

j). I believe that this course's content is highly relevant to any engineering field dealing with energy systems like design of power plant operations and industrial process optimization.

k). I spent roughly 90 minutes to two hours on this test. My time was organized into reading the problem, setting up equations, solving step by step, and reviewing my answers. In the future, Next time, I would spend more time reviewing concepts beforehand and practicing similar problems to improve speed and accuracy during the test.

Question 2

1)

For Test 1 Question 2, I was able to show my knowledge of thermodynamics principles related to Rankine Cycles because an additional layer of complexity was introduced by the malfunction of a second steam trap which further impacted the mass extraction fractions, the temperature, and the overall efficiency.

I see that my application of the recalculation strategy was appropriate and that I identified the significant effect on performance when they fail.

This test overall made me feel confident that I have internalized the course material correctly. Specifically, it reinforced the importance of energy balance calculations and it highlighted how interconnected components in a power cycle affect each other

2).

Here, my erroneous calculation of “z” and unnecessary calculation of “w” were seen again. To go even further, Dr Ayala’s work shows that the calculation for “z” was not necessary either if the second trap fails, and as a result the $\Delta t = m_t / m_w$ even further.

3).

From Problem Solution Rubric and Email Rubric;

PROBLEM 2)

1. P-v and T-s diagrams

1/9 out of 1/9

Grade: 1 / 1

Explanation: The provided P-V and T-S Diagrams were accurate with the question.

2. Realize that some states are not needed

1/9 out of 1/9

Grade: 0 / 1

Explanation: The calculation for “z” and “w” were unnecessary.

3. State calculations (at least 8 of them)

2/9 out of 2/9

Grade: 2 / 2

Explanation: The overall strategy Meets Standard and demonstrates an understanding of the concepts from Chapter 10.

4. Calculate “y” and get $y = 0$

1/9 out of 1/9

Grade: 0.75 / 1

Explanation: the calculation Meets Standard, but I did not specifically identify that “ $y = 0$ ” must happen for proper pump operation within the cycle

5. Calculate ΔT water

1/9 out of 1/9

Grade: 1 / 1

Explanation: The diagrams and problem solving strategy demonstrate an understanding of the course objectives

6. Thermal efficiency (W_{net} & Q_{in})

2/9 out of 2/9

Grade: 1.75 / 2

Explanation: The answer meets standards as is was within an acceptable margin of error for calculation differences (42.5% vs 41.9%)

7. Final results

1/9 out of 1/9

Grade: 0.75 / 1

Explanation: The final results were within a reasonable margin of error, but mistakes when erroneously identifying "z" and "w"

TOTAL

7.25 out of 9/9

4)

a). One of the main issues I encountered was correctly identifying which of the mass extraction fractions were needed and ensuring that all energy balance equations were correctly applied. I struggled with identifying the correct relationships between the mass fractions and the broken system components

b). To complete the test, I applied the necessary energy balance equations to determine the mass fractions. Afterward, I calculated the cooling water temperature rise, heat rejection, net power, and efficiency.

c). In this portion, reinforced my understanding of how steam extraction affects cycle efficiency and heat rejection

d). In my work as an Engineering Technician for the Mack Truck production plant in Salem, VA, I work with engineers who apply these concepts in plant operations.

e). I expect to use this knowledge in any field related to energy systems, whether in power generation, HVAC systems, or industrial steam processes

f). Yes, I believe that many industries rely on thermodynamic cycles, and being able to analyze and troubleshoot system inefficiencies

g). I believe that I will utilize these concepts in the future if optimizing power generation systems, evaluating energy losses, and designing more efficient thermal processes

h). Yes, I have utilized similar problem-solving approaches in other courses and projects..

i). I believe that I was most successful in my ability to apply the correct energy balance equations and determine key performance indicators like efficiency and heat rejection.

j). I believe that this course's content connects to my field, as energy efficiency and system optimization are critical in many engineering applications.

k). I spent roughly 90 minutes to two hours on this test. My time was organized into reading the problem, setting up equations, solving step by step, and reviewing my answers. In the future, Next time, I would spend more time reviewing concepts beforehand and practicing similar problems to improve speed and accuracy during the test.