David Loveland

Professor Ayala

MET 350

3/19/2024

TEST 2

Name: David Loveland

MET 350 Thermal Applications
Dr. Orlando Ayala
Spring 2024
Test 2

Take home – Due Tuesday March 19th, 2024, before class time.

READ FIRST

1. RELAX!!!! DO NOT OVERTHINK THE PROBLEMS!!!! There is nothing hidden. The test was designed for you to pass and get the maximum number of points, while learning at the same time. HINT: THINK BEFORE TRYING TO USE/FIND EQUATIONS (OR EVEN FIND SIMILAR PROBLEMS)
2. The total points on this test are one hundred (100). Ten (10) points are from your HW assignments, and ten (10) other points are based on the basis of technical writing. The other eighty (80) points will come from the problem solutions. For the technical writing I will follow the attached rubric.
3. There is 1 problem worth 80 points.
4. What you turn in should be only your own work. You cannot discuss the exam with anyone, except me. Call me, skype me, text me, email me, come to my office, if you have any question.
5. I do not read minds. You should be explicit and organized in your answers. Use drawings/figures. If you make a mistake, do not erase it. Rather use that opportunity to explain why you think it is a mistake and show the way to correct the problem.
6. You have to turn in your test ON TIME and ONLY through CANVAS. You must submit only one file and it has to be a pdf file. For the ePortfolio (which is optional) you are supposed to upload this artifact to your Google drive. I will provide more instructions later.
7. Do not start at the last minute so you can handle anything that could happen. Late tests will not be accepted. Test submitted through email will not be accepted either.
8. Cheating is completely wrong. The ODU Student Honor Pledge reads: "I pledge to support the honor system of Old Dominion University. I will refrain from any form of academic dishonesty or deception, such as cheating or plagiarism." By attending Old Dominion University, you have accepted the responsibility to abide by this code. This is an institutional policy approved by the Board of Visitors. It is important to remind you the following part of the Honor Code:

   IX. PROHIBITED CONDUCT
   A. Academic Integrity violations, including:
   1. *Cheating*: Using unauthorized assistance, materials, study aids, or other information in any academic exercise (Examples of cheating include, but are not limited to, the following: using unapproved resources or assistance to complete an assignment, paper, project, quiz or exam; collaborating in violation of a faculty member's instructions; and submitting the same, or substantially the same, paper to more than one course for academic credit without first obtaining the approval of faculty).

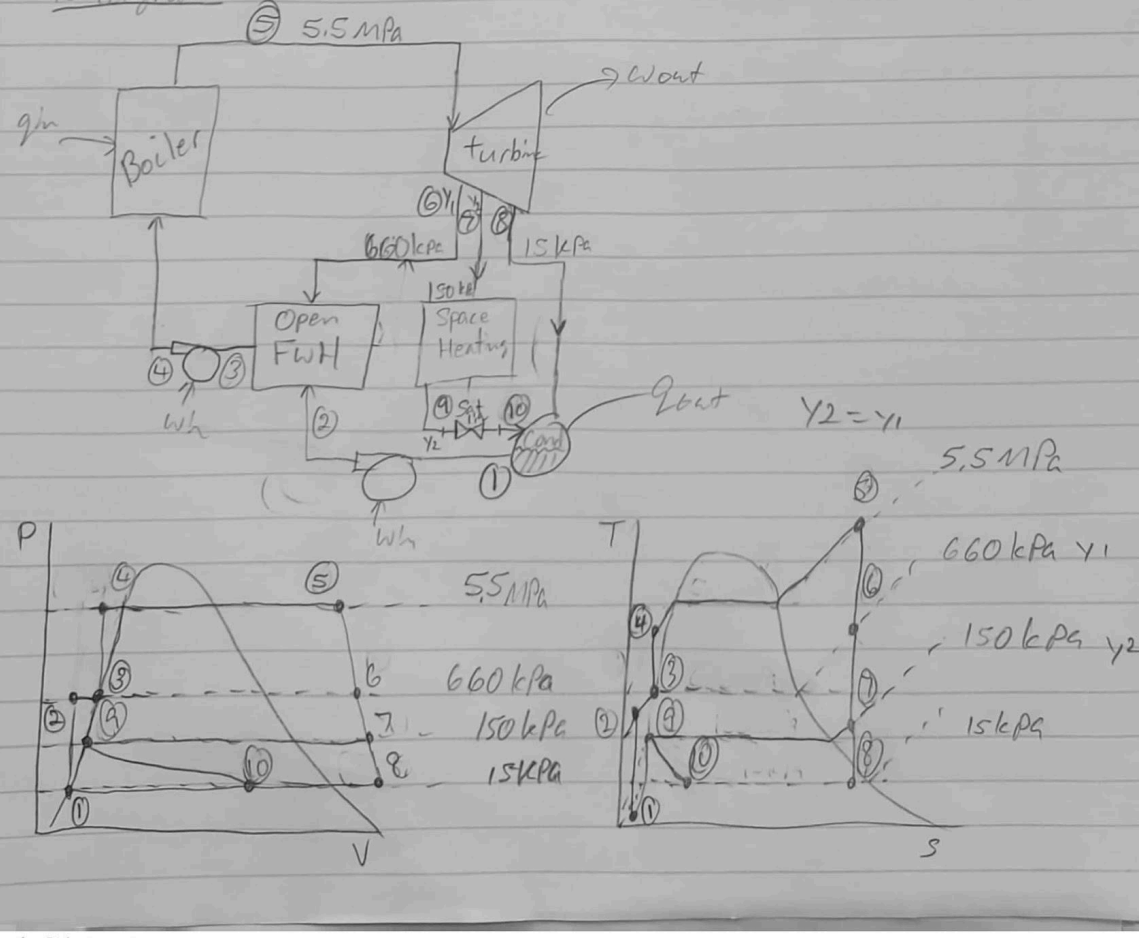
With that said, you are NOT authorized to use any online source of any type, unless is ODU related.

Test 2

Purpose

Determine utilization factor and turbine work for facility using steam power plant. With a 50,000 kW load, find the mass entering the turbine. Determine the heat to the working areas for conditions in turbine. Determine all states, mass fractions y_2 and y_1, and rate of heat removed from condenser.

Diagram



Source:

Cengel & Boles, Thermodynamics - An Engineering Approach, 9th edition, McGraw Hill, 2015

Design Considerations:

1) Water (pure) steam
2) regenerative cycle
3) No heat losses in connections, pipes, neither fluid flow friction losses.

Data variables

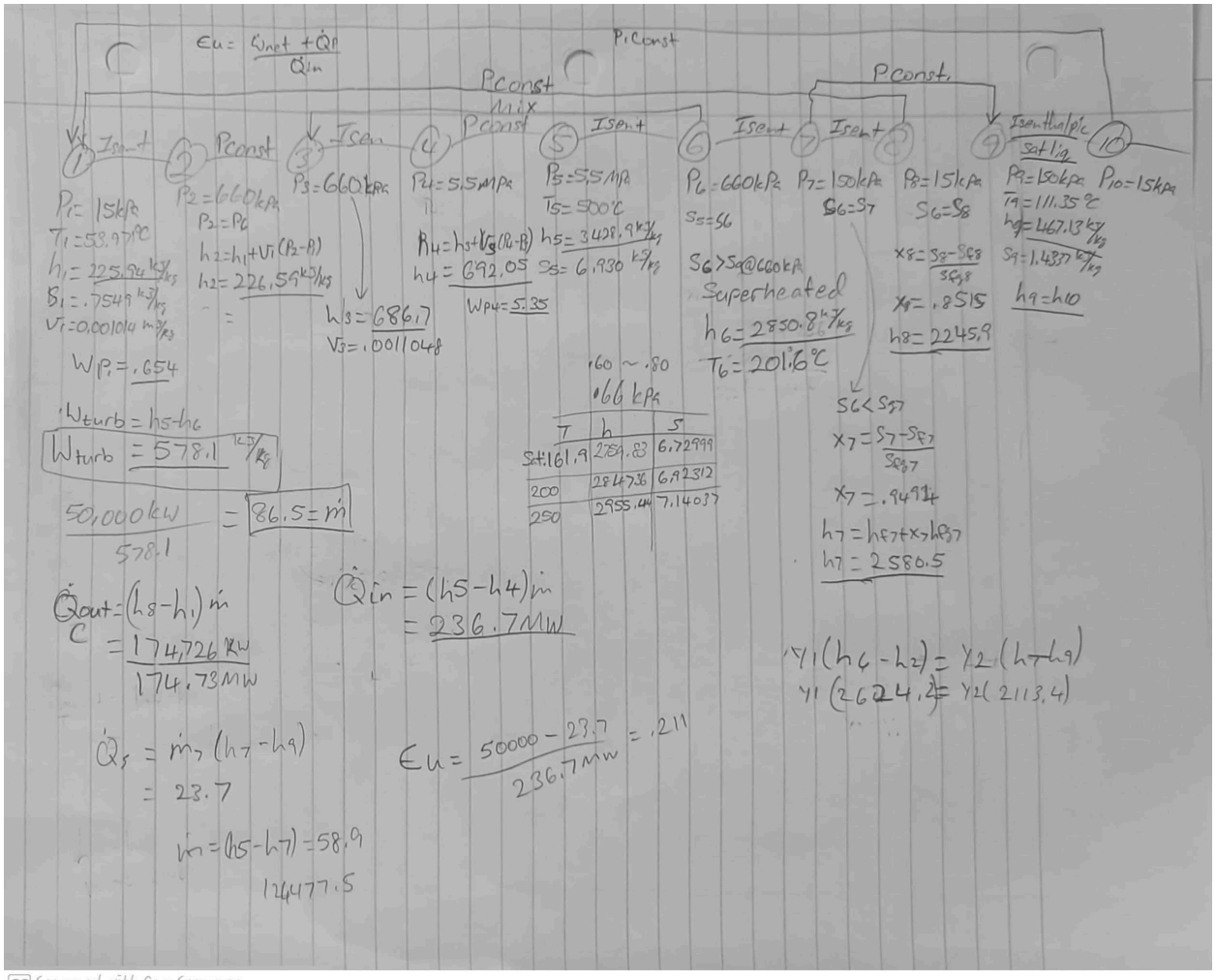
$P_{turbin} = 5.5\ MPa$, $T = 500°C$ $\dot{W} = 50{,}000\ kW$

$P_{FWH} = 660\ kPa$

$P_{space\ H} : 150\ kPa$

$P_{cond} : 15\ kPa$

Materials : water



Summary

The Turbine work came out to be 578.1 kJ/kg. The heat supplied to the turbine, 1236.7 MW. Heat remove from condenser is 174.73 MW. All states have been determined. Diagrams have been drawn.

Analysis

With a 50,000 kW load, the $\dot{m}$ is 86.5 kg/s.
W_{tur} = 578.1 kJ/kg, heat supplied is 236.7 MW.