MET 355

Test 1

2/23/25

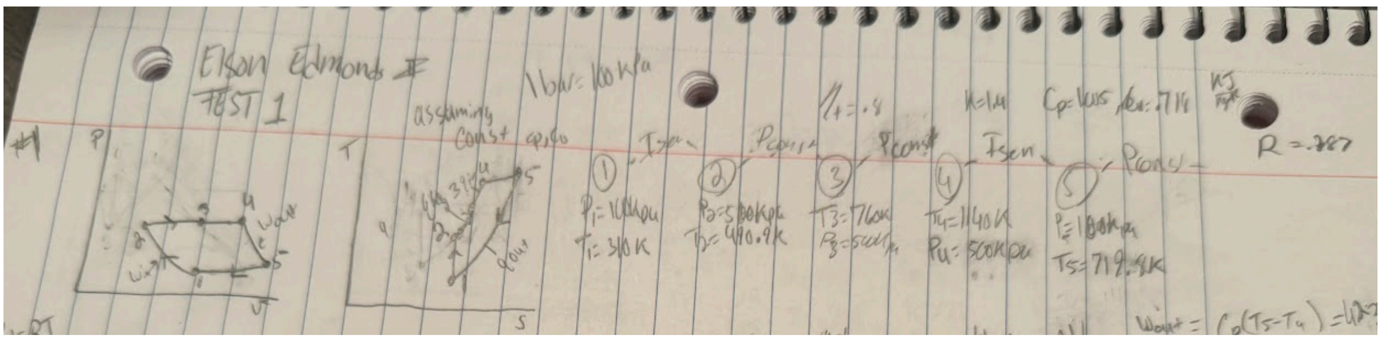
Elson Edmonds II

eedmo003@odu.edu

1.

Purpose:
(a) Determine the thermal efficiency and the heat exchanger effectiveness.
(b) the air mass flow rate, in kg/s, for a net power output of 500 kW.
(c) what would be the thermal efficiency if the heat exchanger were operating at 100% effectiveness?

Diagram and variables:



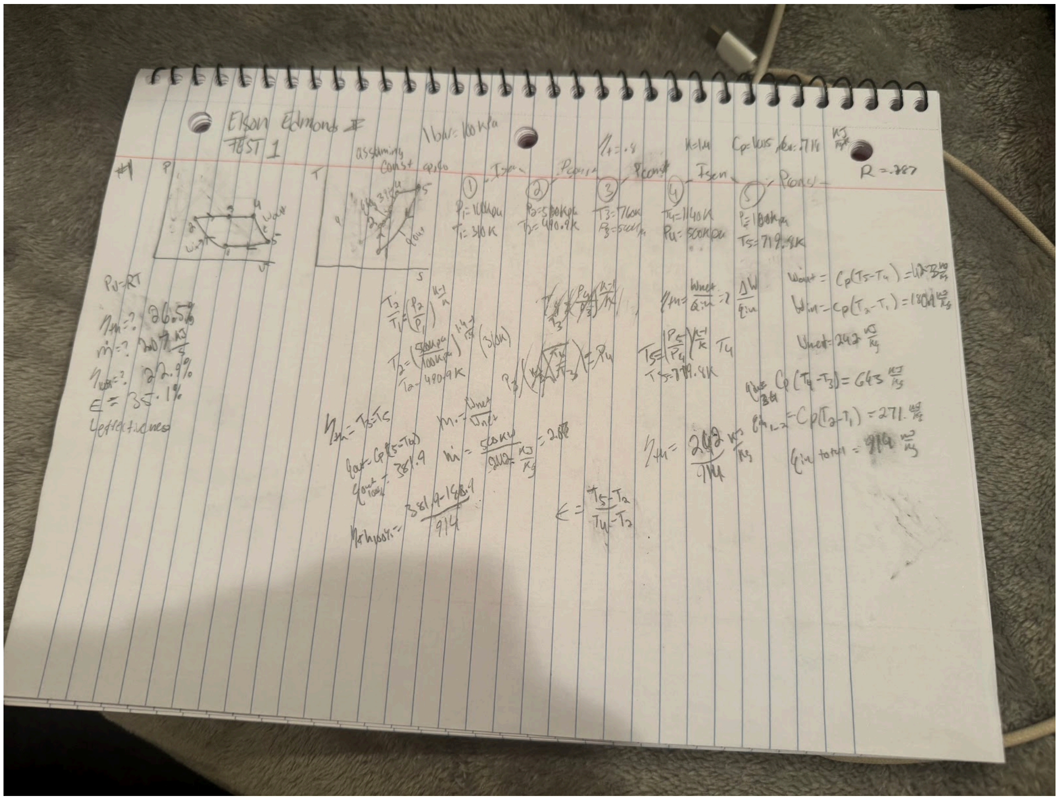
Sources:

Notes from class
Appendix 1

Design Considerations:

Based on the description, I assumed:
Ideal cold air-standard
Brayton cycle
Constant cp,cv

Procedure and Calculations:



Summary:

The thermal efficiency is 26.5%
The heat exchanger effectiveness si 2.01 kJ/s
The air mass flow rate, in kg/s, for a net power output of 500 kW is 22.9%
The thermal efficiency if the heat exchanger were operating at 100% effectiveness is 35.1%

Analysis:

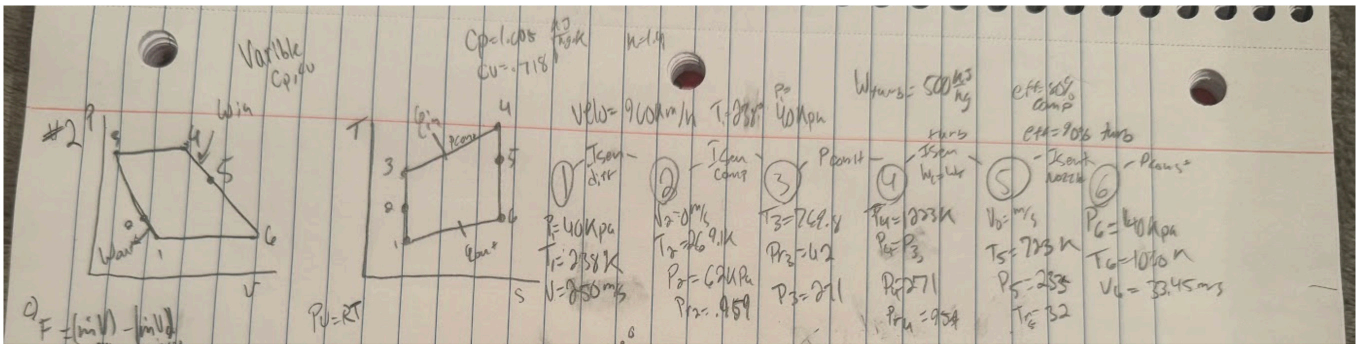
These results make sense due to the theories that we have learned in class from as about the brayton cycles and the patterns that recur. The only thing that doesn't make sense with my answers is the fact that my calculations say that the efficiency of the cycle at 100% is lower than the efficiency of the cycle based off of the problem statement.

2.

Purpose:

(a) Determine the pressure of combustion gases at the turbine exit,
(b) the velocity of the gases at the nozzle exit, and
(c) the thrust for this engine if the diffuser inlet diameter is 1.6 m.

Diagram and variables:



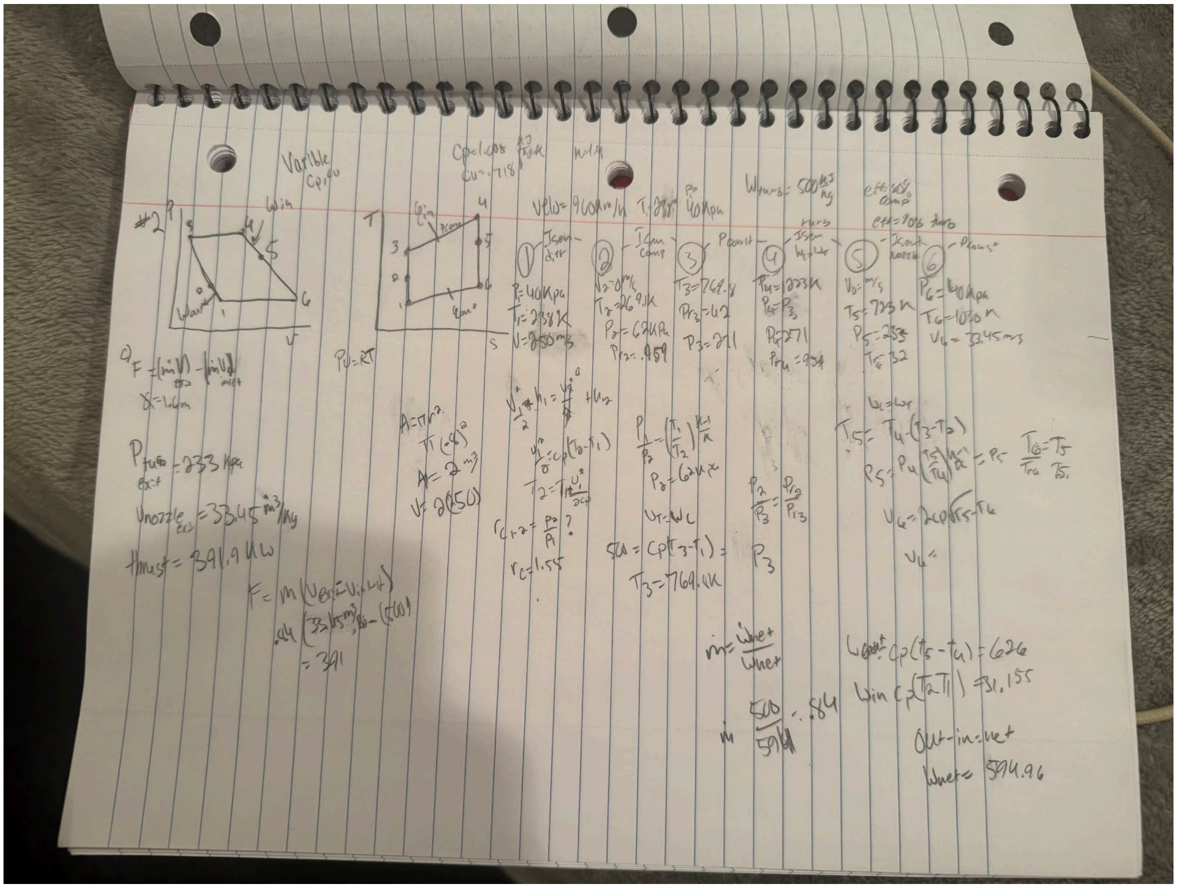
Sources:

Notes from class.
Appendix 1

Design Considerations:

Based on the description, I assumed:
Jet cycle
Variable cp,cv, evaluated at 238 K

Procedure and Calculations:



Summary:

The pressure of combustion gases at the turbine exit is 233 Kpa
The velocity of the gases at the nozzle exit is 33.45 m^3/kg
The thrust for this engine is 391.9 kW

Analysis:

These results make sense due to the theories that we have learned in class from as about the jet cycles and the patterns that recur. My answers seem to be of reasonable assumption based on the theories that we have discussed in class.