

Mech 262 – assignment 5

rankine cycle with open feedwater heater and component efficiency.

Question 1

A regenerative vapour power cycle has one open feedwater heater. Steam enters the turbine at 15 MPa, 600°C and expands to 1.2 MPa, where some of the steam is extracted and diverted to the open feedwater heater operating at 1.2 MPa. The remaining steam expands through the second-stage turbine to the condenser pressure of 0.010 MPa. Saturated liquid exits the open feedwater heater at 1.2 MPa. The turbines and the pumps are perfect in that their isentropic efficiencies can be taken as 100%.

If the net power output of the plant is 20 MW, determine:

- a. The thermal efficiency of the plant; and,
- b. The mass flowrate of steam entering the first turbine stage, kg/s.

(Answer: 45.55 %, 15.88 kg/s)

Question 2

Repeat question 1, but this time use:

- A real, non-ideal high pressure turbine with an isentropic efficiency of 89.56%;
- A real low-pressure turbine with an isentropic efficiency of 92%; and,
- Pumps with isentropic efficiencies of 80%.