Problem set 2

Consider a steam power plant that operates on a reheat Rankine cycle and has a net power output of 80 MW. Steam enters the high pressure turbine at 10 MPa and 500°C and the low pressure turbine at 1 MPa and 500°C. Steam leaves the condenser as a saturated liquid at a pressure of 10 kPa. The isentropic efficiency of the turbine is 80%, and that of the pump is 95%.

a) Show the cycle on a T-s diagram.

b) Determine the quality (or temperature, if superheated) of the steam at the turbine exit.

c) Determine the thermal efficiency of the cycle.

d) Determine the mass flow rate of the steam.

A steam power plant operates on a regenerative Rankine cycle. Steam enters the turbine at 6 Mpa and 450°C and is condensed at 20 kPa. Steam is extracted from the turbine at 0.4 MPa to heat feedwater in an open feedwater heater. Water leaves the feedwater as a saturated liquid. Show the cycle on a T-s diagram. Determine

a) The net work output per kilogram of steam flowing through the boiler.

b) The thermal efficiency of the cycle.