ASSIGNMENT # 2
Due in class 09/24/13 at 11.05AM

Homework policy: Assignments will NOT be accepted past the due date. Lowest homework grade will be dropped.

Note: All reading and problems below are from Moran and Shapiro, Fundamentals of Engineering Thermodynamics.

Suggested reading: Chapter 6: Entropy (problems 1, 2), Chapter 8: Vapor power cycles (problems 3,4)

PROBLEMS

[1] (25%) Steam at 1.0 MPa and 300°C enters an insulated turbine operating at steady state and exits at 15 kPa, Kinetic and potential energy effects are negligible. If the work developed by the turbine is measured as 630 kJ per kg of steam flowing through the turbine, evaluate the isentropic turbine efficiency.

[2] (25%) In Problem 4 of Hw #1, determine the rate of entropy production, in Btu/h °R.

[3] (25%) Water is the working fluid in a Carnot vapor power cycle. Saturated liquid enters the boiler at a pressure of 8 MPa, and saturated vapor enters the turbine. The condenser pressure is 8 kPa. Determine:
(a) the thermal efficiency
(b) the back work ratio
(c) the heat transfer to the working fluid per unit mass passing through the boiler, in kJ/kg
(d) the heat transfer from the working fluid per unit mass passing through the condenser, in kJ/kg.

[4] (25%) Water is the working fluid in an ideal Rankine cycle with superheating. The pressure and temperature at the turbine inlet are 1200 lbf/in² and 1000°F, respectively, and the condenser pressure is 1 lbf/in². The mass flow rate of steam entering the turbine is 1.4 × 10⁶ lb/h. The cooling water experiences a temperature increase from 60 to 80°F, with negligible pressure drop, as it passes through the condenser. Determine for the cycle:
(a) the net power developed, in Btu/h
(b) the thermal efficiency
(c) the mass flow rate of cooling water, in lb/h