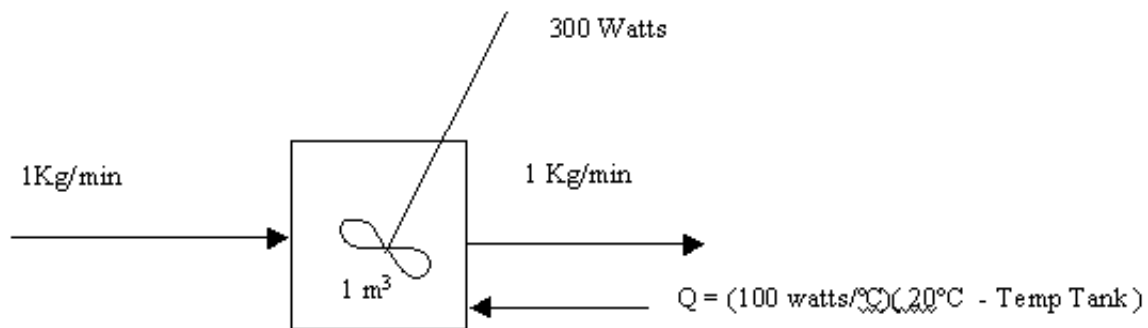


10.213 Fall 1999 Homework

PS 15 & 16 & 17

Problem 15 (due Monday 10/25/99)

A stream of water flows through a metal tank. The tank contains a stirrer that assures that the water and tank temperature is uniform within the tank and the walls of the tank are at the same temperature as the water. The stirrer uses 300 watts of mechanical power. The amount of water in the tank is at steady state, i.e. it does not vary with time, and is 1 m^3 . The heat capacity of the tank has been measured to be 10% of that of the water within the tank. The tank loses/gains heat from the surroundings in proportion to the temperature difference between the water-tank temperature and the surrounding temperature with a heat transfer coefficient of $100 \text{ watts}/^\circ\text{C}$. The mass flow rate of water in and out is $1 \text{ Kg}/\text{min}$. The surroundings temperature is 20°C .



- a) For steady-state conditions with a water inflow temperature of 40°C , what is the outflow temperature of the water?
- b) What is the temperature transient of the tank water temperature as result of change the temperature of the inflow water from 40°C to 60°C at time equal to t_0 ?

Problem 16 (due Wednesday, 10/27/99)

Calculate the rate lost work associated with the process described in Problem 15, part a, and identify all sources of irreversibility.

Problem 17 (due Friday, 10/29/99)

Solve problem 16.17 on page 629 of your text.