

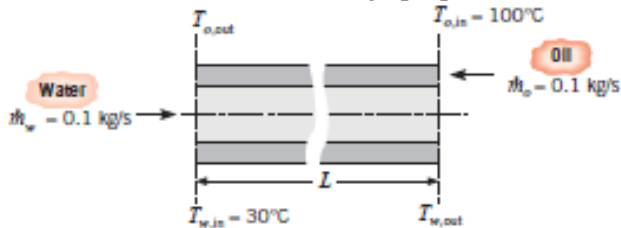
Birzeit University
Mechanical & Mechatronics Engineering Department
Heat Transfer ENME 431
Homework 11 Heat exchangers

Instructor: Dr. Afif Akel Hasan

11.9 A finned-tube, cross-flow heat exchanger is to use the exhaust of a gas turbine to heat pressurized water. Laboratory measurements are performed on a prototype version of the exchanger, which has a surface area of 10m^2 , to determine the overall heat transfer coefficient as a function of operating conditions. Measurements made under particular conditions, for which $m_h = 2\text{ kg/s}$, $T_{h,i} = 325^\circ\text{C}$, $m_c = 0.5\text{ kg/s}$, and $T_{c,i} = 25^\circ\text{C}$, reveal a water outlet temperature of $T_{c,o} = 150^\circ\text{C}$. What is the overall heat transfer coefficient of the exchanger?

11.14 A shell-and-tube exchanger (two shells, four tube passes) is used to heat $10,000\text{ kg/h}$ of pressurized water from 35 to 120°C with 5000 kg/h pressurized water entering the exchanger at 300°C . If the overall heat transfer coefficient is $1500\text{ W/m}^2\cdot\text{K}$, determine the required heat exchanger area.

11.23 A concentric tube heat exchanger for cooling lubricating oil is comprised of a thin-walled inner tube of 25-mm diameter carrying water and an outer tube of 45-mm diameter carrying the oil. The exchanger operates in counter flow with an overall heat transfer coefficient of $60\text{ W/m}^2\cdot\text{K}$ and the tabulated average properties.



Properties	Water	Oil
ρ (kg/m^3)	1000	800
c_p ($\text{J/kg}\cdot\text{K}$)	4200	1900
ν (m^2/s)	7×10^{-7}	1×10^{-5}
k ($\text{W/m}\cdot\text{K}$)	0.64	0.134
Pr	4.7	140

- If the outlet temperature of the oil is 60°C , determine the total heat transfer and the outlet temperature of the water.
- Determine the length required for the heat exchanger.