Michigan Tech
CM3110 Morrison HW 6

Answers to Assigned Problems:

1. Create a summary list of all the correlations for heat transfer coefficient given in your text. See lecture notes for an example.
2. Geankoplis 4.5-6: $84 \text{ lb}_m/\text{h}$
3. Geankoplis 4.7-1: $h = 5.4 \text{ W/m}^2$, $q = 92 \text{ W/m}$ (not using the simplified equation); $q = 85\text{ W/m}$ (simplified equation)
4. Geankoplis 4.7-3: $Q = 45\text{ W}$
5. Geankoplis 4.5-4: $T_1' = 299.5^\circ C$, $A = 97\text{ m}^2$
6. Geankoplis 4.5-4, except with shell-and-tube heat exchanger: $T_1' = 299.5^\circ C$, $A = 97\text{ m}^2$
7. Water flowing at a rate of $0.723 \text{ kg/s}$ enters the inside of a countercurrent, double-pipe heat exchanger at $300. K$ and is heated by an oil stream that enters at $385 K$ at a rate of $3.2 \text{ kg/s}$. The heat capacity of the oil is $1.89\text{ kJ/kg K}$ and the average heat capacity of water over the temperature range of interest is $4.192 \text{ kJ/kg K}$. The overall heat-transfer coefficient of the exchanger is $3.0 \times 10^2 \text{ W/m}^2\text{ K}$, and the area for heat transfer is $15.4 \text{ m}^2$. What is the total amount of heat transferred? Answer: $175\text{ kW}$.
8. Geankoplis 4.10-3: $160\text{ W}$
9. A horizontal heated plate of dimensions $1.0 \times 1.0 \text{ m}$ is heated to $50^\circ C$. The air over the plate is at a temperature of $25.0^\circ C$. What is the total heat flux from the plate to the air? The emissivity of the plate is 0.89. Answer: $260\text{ W}$. What mechanism dominates heat transfer (if any)?
10. Geankoplis 4.11-1: a) $14,000 \text{ W/m}^2$, b) $4500 \text{ W/m}^2$
11. Geankoplis 4.7-8: We need to calculate radiation, natural convection, and conduction (through the air) contributions to the total. Answers: radiation contribution $5.5\text{ kW}$; natural convection contribution $2.4 \text{ kW}$; conduction contribution $0.7 \text{ kW}$; total $8.6 \text{ kW}$.
12. Geankoplis 5.6-2: no solution provided

Answers to Stretch Problems:

1. Geankoplis 5.3-6: $13.5 \text{ hr}$