Assignment 4

Due on 2023-05-08, 22:00 UT

Read Chapter 1 of the text. For the upcoming weeks you are supposed to submit Assignment 1.

1. Consider two parallel-plate horizontal plate heat exchangers through which steam at 90°C and water at 10°C are passed. The steam flow rate is 5 kg/s and the water flow rate is 0.5 kg/s. Calculate the heat transfer rate between the steam and water. The steam-side side heat transfer coefficient is 150 W/m²K, and the water-side side heat transfer coefficient is 50 W/m²K. Assume the interface temperature is 70°C.

2. A finned-tube heat exchanger is used to cool a gas stream. The finned-tube heat exchanger has a total surface area of 10 m² and a fin effectiveness of 0.9. The gas stream enters the heat exchanger at 150°C and leaves at 100°C. The cooling water enters the heat exchanger at 20°C and leaves at 40°C. Calculate the heat transfer rate between the gas stream and the cooling water. The heat transfer coefficient between the gas stream and the fins is 50 W/m²K, and the heat transfer coefficient between the cooling water and the fins is 100 W/m²K.

3. A shell-and-tube heat exchanger is used to cool a liquid stream. The shell-side side heat transfer coefficient is 100 W/m²K, and the tube-side side heat transfer coefficient is 50 W/m²K. The liquid stream enters the shell side at 100°C and leaves at 60°C. The cooling water enters the tube side at 20°C and leaves at 40°C. Calculate the heat transfer rate between the liquid stream and the cooling water. Assume the interface temperature is 70°C.

4. A plate-fin heat exchanger is used to cool a liquid stream. The plate-fin heat exchanger has a total surface area of 5m² and a fin effectiveness of 0.8. The liquid stream enters the heat exchanger at 120°C and leaves at 60°C. The cooling water enters the heat exchanger at 20°C and leaves at 40°C. Calculate the heat transfer rate between the liquid stream and the cooling water. The heat transfer coefficient between the liquid stream and the fins is 150 W/m²K, and the heat transfer coefficient between the cooling water and the fins is 100 W/m²K.

5. A shell-and-tube heat exchanger is used to cool a gas stream. The shell-side side heat transfer coefficient is 100 W/m²K, and the tube-side side heat transfer coefficient is 50 W/m²K. The gas stream enters the shell side at 200°C and leaves at 100°C. The cooling water enters the tube side at 20°C and leaves at 40°C. Calculate the heat transfer rate between the gas stream and the cooling water. Assume the interface temperature is 70°C.

6. A spiral heat exchanger is used to cool a liquid stream. The spiral heat exchanger has a total surface area of 10 m² and a spiral effectiveness of 0.9. The liquid stream enters the heat exchanger at 100°C and leaves at 60°C. The cooling water enters the heat exchanger at 20°C and leaves at 40°C. Calculate the heat transfer rate between the liquid stream and the cooling water. The heat transfer coefficient between the liquid stream and the fins is 150 W/m²K, and the heat transfer coefficient between the cooling water and the fins is 100 W/m²K.

7. A finned-tube heat exchanger is used to cool a liquid stream. The finned-tube heat exchanger has a total surface area of 10 m² and a fin effectiveness of 0.9. The liquid stream enters the heat exchanger at 100°C and leaves at 60°C. The cooling water enters the heat exchanger at 20°C and leaves at 40°C. Calculate the heat transfer rate between the liquid stream and the cooling water. The heat transfer coefficient between the liquid stream and the fins is 150 W/m²K, and the heat transfer coefficient between the cooling water and the fins is 100 W/m²K.

8. A shell-and-tube heat exchanger is used to cool a gas stream. The shell-side side heat transfer coefficient is 100 W/m²K, and the tube-side side heat transfer coefficient is 50 W/m²K. The gas stream enters the shell side at 200°C and leaves at 100°C. The cooling water enters the tube side at 20°C and leaves at 40°C. Calculate the heat transfer rate between the gas stream and the cooling water. Assume the interface temperature is 70°C.

9. A spiral heat exchanger is used to cool a liquid stream. The spiral heat exchanger has a total surface area of 10 m² and a spiral effectiveness of 0.9. The liquid stream enters the heat exchanger at 100°C and leaves at 60°C. The cooling water enters the heat exchanger at 20°C and leaves at 40°C. Calculate the heat transfer rate between the liquid stream and the cooling water. The heat transfer coefficient between the liquid stream and the fins is 150 W/m²K, and the heat transfer coefficient between the cooling water and the fins is 100 W/m²K.

10. A finned-tube heat exchanger is used to cool a gas stream. The finned-tube heat exchanger has a total surface area of 10 m² and a fin effectiveness of 0.9. The gas stream enters the heat exchanger at 200°C and leaves at 100°C. The cooling water enters the heat exchanger at 20°C and leaves at 40°C. Calculate the heat transfer rate between the gas stream and the cooling water. The heat transfer coefficient between the gas stream and the fins is 150 W/m²K, and the heat transfer coefficient between the cooling water and the fins is 100 W/m²K.