# CHE312A: Homework 4

Instructions: Upload your original, legible and handwritten solution in pdf format, with the exact filename ⟨yourrollnumber⟩.pdf (e.g. 06302016.pdf). Include your name and roll number on the top of the first page. Include all necessary steps in detail, define all symbols and state all assumptions made in your solution. Use material properties reported in appendices of either Incropera's or Cengel's book.

1. A 20 mm diameter electric transmission line carries an electric current of 80 A and has a resistance of 0.02 ohm per meter length. Determine the surface temperature of the wire, $T_s$, during a windy day when air temperature is 20°C and the wind is blowing across the transmission line at 50 km/h. First solve using properties of air at 20°C, and perform the next iteration with air properties at the average film temperature ($[0.5 \times (T_s + 20)]$°C). (3 points)

2. In the setup described in problem 1, if the circular cross-section line is replaced by a square cross-section cylinder with a 20 mm diagonal, what is the change in the resulting surface temperature relative to that in problem 1? (3 points)

3. Water at 10°C is to be heated to 70°C as it flows at a rate of 5 L/min through a 2 cm internal diameter and 12 m long pipe that is equipped with an electric resistance heater that provides uniform heating throughout the surface of the pipe. The outer surface of the heater is well insulated. What is the inner surface temperature of the pipe at half the pipe length from the entrance (mid-point)? Use properties of water at the average temperature of 40°C. (4 points)