MAE 3314: Heat Transfer
Practice Problems for Exam 1

1. **[easy]** A laboratory furnace wall is constructed of 0.2 m thick fireclay brick having k_a=1.0W/m·K. This is covered on the outer surface with a 0.03m thick layer of insulating material having k_b=0.07W/m·K. The furnace inner brick surface is at 1250 K and the outer surface of the insulation material is at 310K. Calculate the steady state heat transfer rate through the wall in W/m^2, and determine the interfacial temperature T_2 between the brick and the insulation.

2. **[intermediate]** A very long, 1cm diameter copper rod (k=377 W/m·K) is exposed to an environment at 22^{o}C. The base temperature of the rod is maintained at 150 ^{o}C. The heat transfer coefficient between the rod and the surrounding air is 11 W/m^2·K. Determine the heat transfer rate from the rod to the surrounding air.

3. **[difficult]** A 2.5 cm o.d. tube is fitted with 5.0 cm o.d. annular fins spaced on 0.50 cm centers. The fins are aluminum alloy (k=161W/m·K) are of constant thickness 0.0229 cm. The external free convective heat transfer coefficient to the ambient air is 8.5 W/m^2·K. For a tube wall temperature of 165^{o}C and an ambient temperature of 27^{o}C, determine the heat loss per meter of length of finned tube.

4. **[intermediate]** Determine the time required for a 1.25cm diameter carbon steel (1%C) (k=40W/m·K, density:7800 kg/m^3, heat capacitance: 473W·s/kg·K)sphere to cool from T_1=500^{o}C to 100oC if exposed to a cooling air flow at T_∞=25^{o}C resulting in h=110 W/m^2·K

Hyejin Moon (Hyejin.moon@uta.edu)