QUIZ TWO

October 19, 2004

The surfaces of the very long, thin strip heater and its hemi-cylindrical shell, discussed in the recitation problem for October 19, are now gray and diffuse. The emissivity of both sides of the thin strip heater is 0.8 and the emissivity of both sides of the reflector is 0.6. The heat transfer coefficient for each side of the reflector is 15 W/m^2K as in part (c) of the recitation problem. You may neglect any convective heat transfer from the heater strip. All dimensions and other parameters given in the recitation problem remain unchanged. You may use the view factors calculated in class (and given below) and assume that the surroundings are much larger than the strip heater and its reflector.

a) Calculate the temperature of the reflector. An answer within 25K will suffice.

b) Calculate the energy required per unit length of heater to maintain its temperature at 1100^0C. An answer within 10% will suffice.

Using the notation in the recitation problem the view factors and parameters are:

$F_{11} = 0$
$F_{12} = 1$
$F_{13} = 0$
$F_{14} = 0$
$F_{21} = 0.085$
$F_{22} = 0.363$
$F_{23} = 0$
$F_{24} = 0.552$
$F_{31} = 0$
$F_{32} = 0$
$F_{33} = 0$
$F_{34} = 1$

Temperature of strip heater is 1100^oC
Temperature of ambient is 20^oC
Diameter of shield is 15cm
Height of heater is 2cm