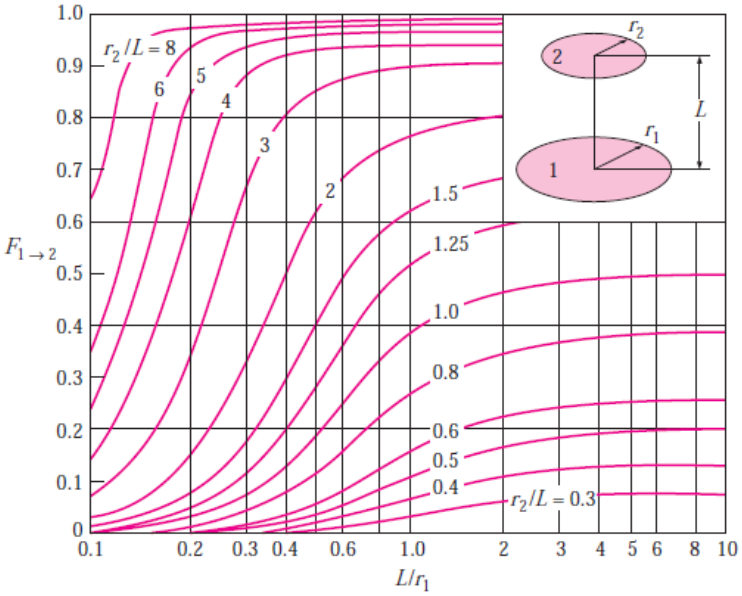
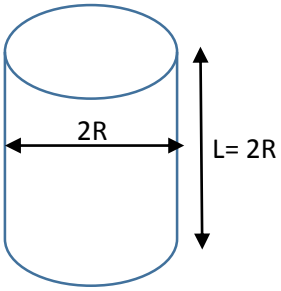
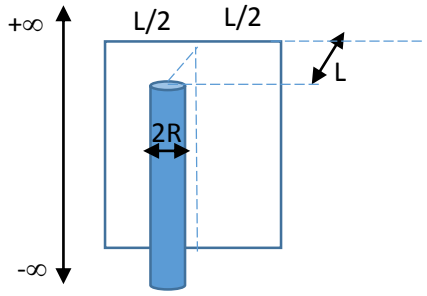
Assignments on Radiation

1. Consider a cylinder as shown in the figure. Determine the view factor of the cylindrical surface with respect to itself and with respect to the base. Use the graph provided below.

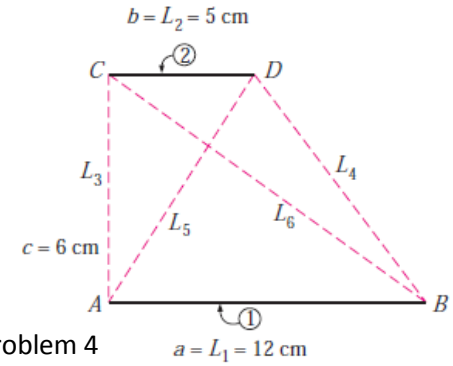




2. If the base and the roof of the cylinder in P1 are at 900 K and the cylindrical surface is maintained at 300 K, find the rate of radiative heat falling on the inside of the cylindrical wall, if R = 1cm.
3. Find the view factor of an infinitely long cylinder of radius R with respect to an infinitely long flat plate: the plate is held parallel to the tube at a distance L=4R (see the figure below). The plate has a width of L in the direction of its finite dimension. Use Hottle's cross-string method.



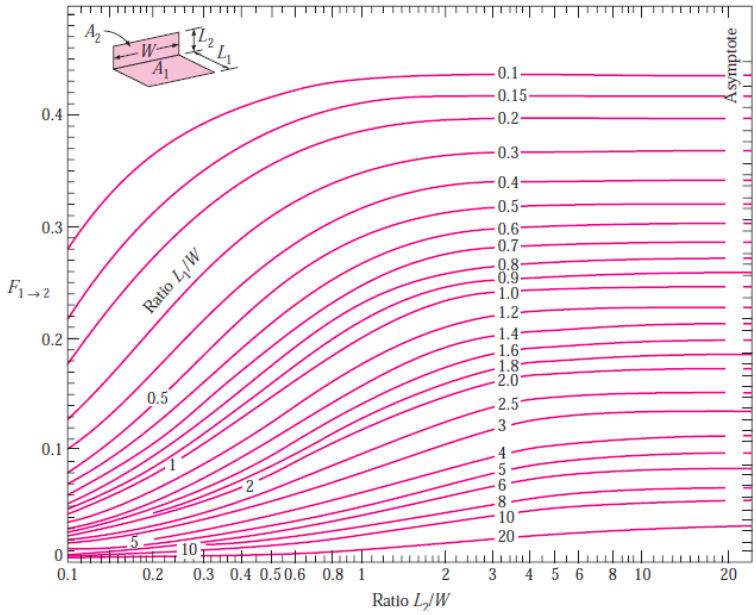
Problem 3

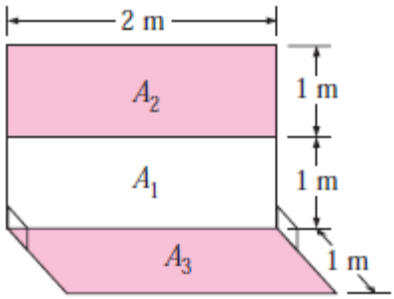


Problem 4

4. Two infinitely long parallel plates of widths a=12 cm and b=5 cm are located a distance c=6 cm apart, as shown in Fig. (a) Determine the view factor F1 → 2 from surface 1 to surface 2 by using the crossed-strings method.

5. Determine the view factor F_{13} and F_{23} in the following figure. Use the following figure for perpendicular plates with a common edge.





Hint: A_1 and A_3 in the right hand side figure are two surfaces with common edge. (A_1+A_2) and A_3 are also common areas.

6. The spectral hemispherical emissivity of an opaque surface at 1200 K is approximated as $\varepsilon_1 = 0$ (for $\lambda < 0.35$ μm), $\varepsilon_2 = 0.85$ (for $0.35 < \lambda < 2.5$ μm), and $\varepsilon_3 = 0$ (for 2.5 μm). Determine the total hemispherical emissivity for the surface. Consult book for the blackbody radiation fraction table.
7. The spectral hemispherical absorptivity of an opaque surface is shown in the graph. Determine the total hemispherical absorptivity of the surface for radiation emitted by a blackbody source at (a) 1000 K and (b) at 3000 K.

Problem 7