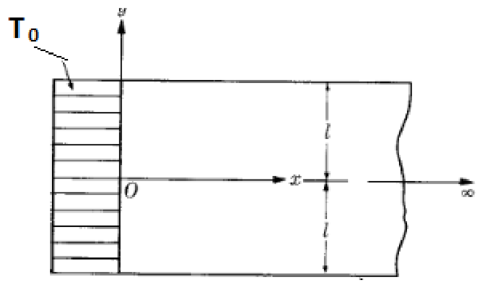
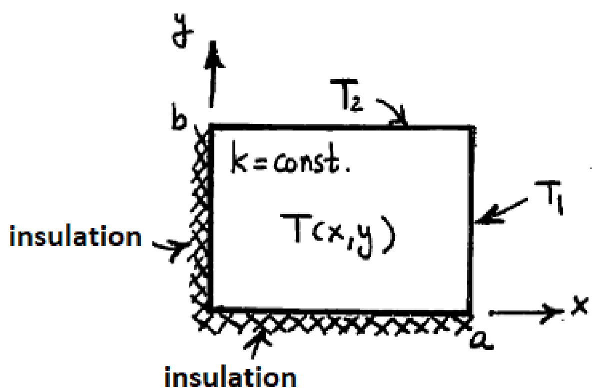
Cankaya University
Faculty of Engineering
Mechanical Engineering Department
Fall 2018
HW 5

P-1) Consider an infinitely long two-dimensional fin of thickness l **as in Figure**. The base temperature of the fin is $F(y)$, the ambient temperature T_∞. The heat transfer coefficient is **large**. **Assume that constant nuclear internal energy $\bar{g}$ (W/m^3) is uniformly generated in the fin. Find the steady temperature of the fin.**



Assume that $F(y) = T_0$ **.**

2) Obtain the steady temperature distribution T(x,y)in the long bar of rectangular cross section shown in figure where T_1 and T_2 **are two known constant temperatures.**

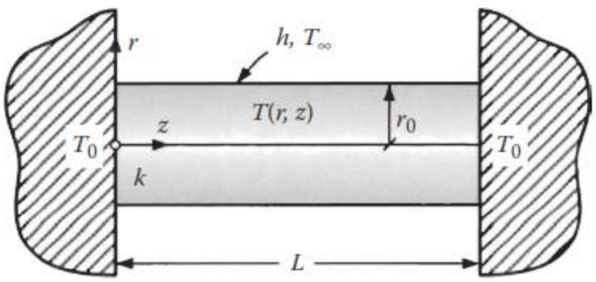


Consider a circular rod of radius r_0, length L, and constant thermal conductivity k as shown in Figure. The rod is supported at its ends by two plates maintained at a constant temperature T_0 and is exposed to a fluid maintained at a constant temperature T_∞, with a constant heat transfer coefficient h at its peripheral surface. Assume perfect thermal contact between the rod and the plates.

(*a*) Obtain an expression for the steady-state temperature distribution $T(r, z)$ in the rod.

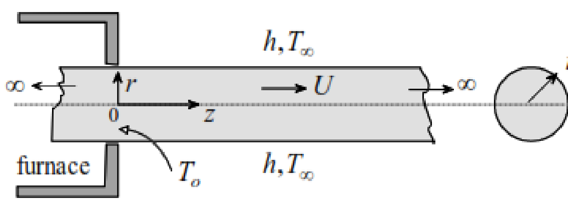
(*b*) What is the rate of heat loss from the rod to the surrounding fluid?

P3)



4)

A rod of radius r_o moves through a furnace with velocity U and leaves at temperature T_o. The rod is cooled outside the furnace by convection. The ambient temperature is T_∞ and the heat transfer coefficient is h. Assuming steady state conduction, determine the temperature distribution.



a) Show tat the differential equation for the temperature distribution is given as

Defining $\theta = T - T_\infty$

$$\frac{\partial^2\theta}{\partial r^2} + \frac{1}{r}\frac{\partial\theta}{\partial r} + \frac{\partial^2\theta}{\partial z^2} - 2\beta\frac{\partial\theta}{\partial z} = 0$$

where $\beta = \rho c_p U / k$, ρ is density and c_p is specific heat.

b) Obtain the solution