In the Name of Most High

Advanced Heat Transfer HW#6

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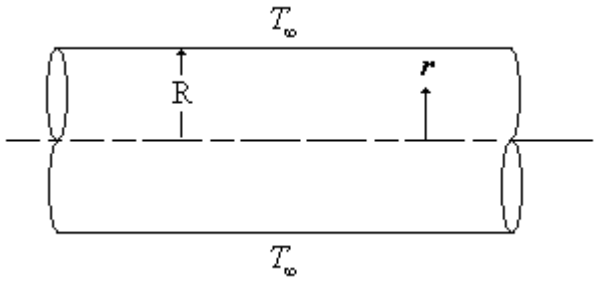
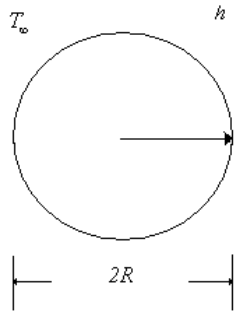
1. Consider a long rod of radii R in temperature of T_i . Suddenly it is exposed to an environment with temperature of T_∞. For the case of large convection heat transfer coefficient, Find the rod transient heat transfer distribution, T (r, t).



2. Consider a sphere with radius of R and uniform initial temperature of T_i. It is suddenly exposed to an environment at temperature of $\boldsymbol{T}_\infty$ having a heat transfer coefficient of h. Find the sphere unsteady state temperature.



3. Consider a long tube with internal radius of r_i and external radius of r_0 with temperature distribution of $f(r)$. It is suddenly immersed in a liquid having temperature of T_∞ and large heat transfer coefficient. Find the tube unsteady state temperature distribution.

4. (**<u>Note: use Laplace transforms method only</u>**) Consider a long thin rod in thermal equilibrium with an environment having temperature of $\boldsymbol{T}_\infty$. The cross section temperature of the rod is suddenly increased to T_0. The convection heat transfer coefficient between the rod and its environment is h and the ratio of the rod cross section area to its perimeter is β.

(a) Find a model that describes the rod transient temperature, $T\ (\ x\ ,\ t\ )$.

(b) compare the model with the following differential equation and find parameters of A and B..

$$\frac{\partial^2 T}{\partial x^2} = A\frac{\partial T}{\partial t} + B(T - T_\infty)$$

(c) Solve the equation by implementing the following conditions :

$$T(0,t) = T_0$$

$$T(\infty,t) = T_\infty$$

$$T(x,0) = T_\infty$$