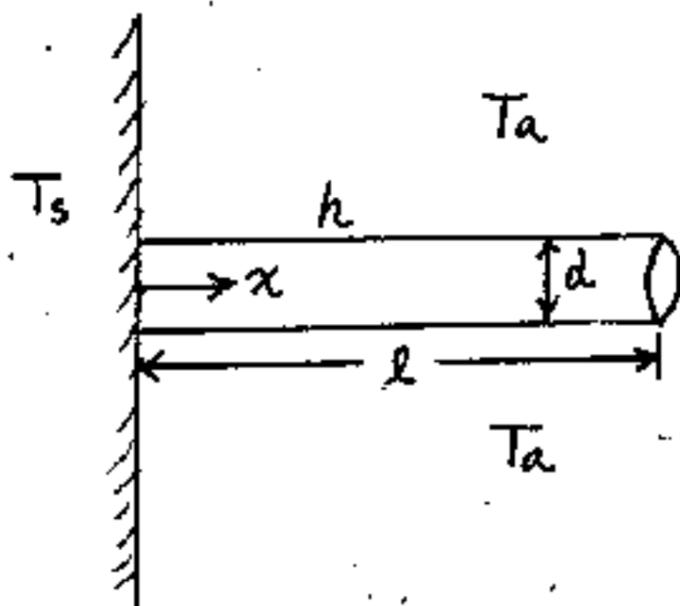


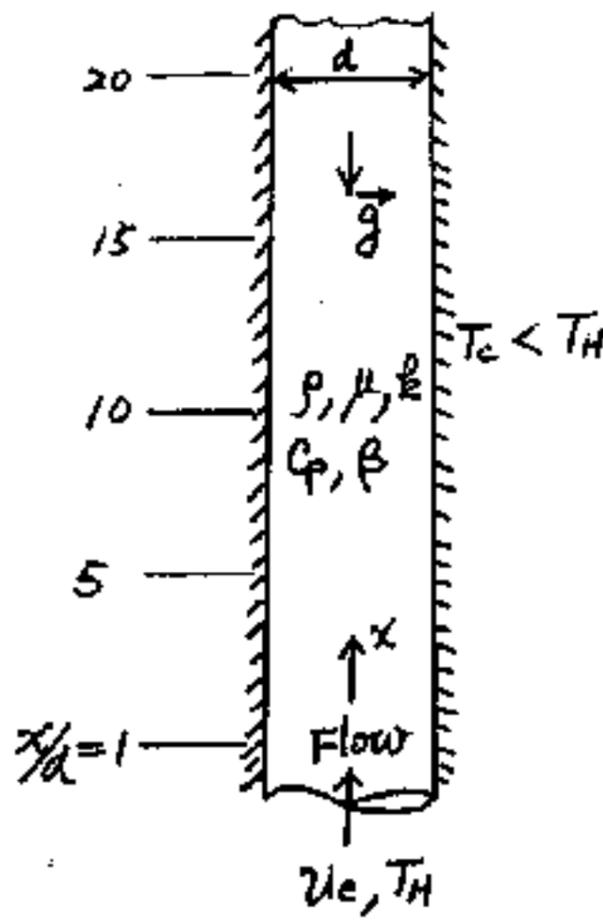
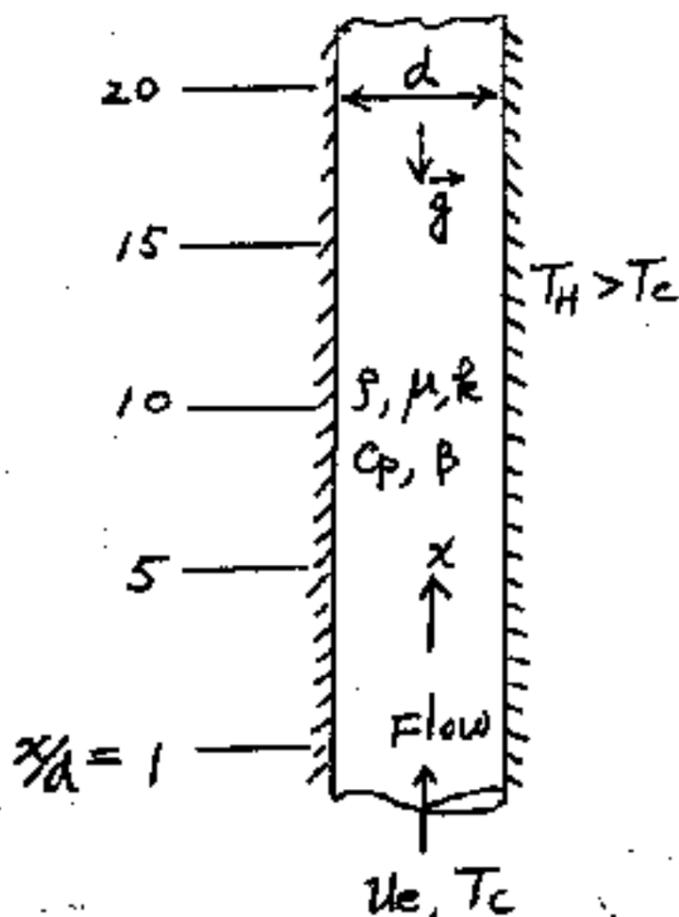
1. Consider the cooling enhancement of a hot solid surface at temperature  $T_s$  by a long circular solid fin placed in a lower temperature ambient  $T_a$ . The fin has a constant thermal conductivity  $k_f$ , diameter  $d$  and length  $l$ , as shown in the figure below. The convective heat transfer coefficient between the fin and ambient is  $h$ . Use a simplified one-dimensional analysis to find the steady temperature distribution in the fin. (20%)



2. Combined forced and natural convection is known to be sensitive to the relative orientation of the inertia and buoyancy forces. For a combined convection flow in a vertical pipe shown in the following figure,  
 (a) derive the relevant dimensionless groups governing the flow and explain their physical meaning.  
 (b) qualitatively plot the velocity profiles at selected cross sections specified on the figure for both aiding and opposing convection. (20%)

Aiding Convection

Opposing Convection



# 國立交通大學八十五學年度碩士班入學考試試題

第 2 頁, 共 2 頁

A3

科目：103 流體力學 (機械工程研究所乙組)

※作答前, 請先核對試題、答案卷(試卷)與准考證上之所組別與考試科目是否相符!!

3. Explain the physical meaning of the following terms: (15%)  
(a) streamline (b) Bernoulli's equation (c) static pressure of fluid

4. (a) Sketch a profile of Pitot tube. (10%)  
(b) Use a Pitot tube to measure air flow velocity which is 2 m/s. What is pressure difference (mmAq) indicated? (5%)  
pressure unit:  $1 \text{ [mmAq]} = 1 \text{ [Kg/m}^2\text{]}$   
density of air:  $1/9.8 \text{ [Kg} \cdot \text{S}^2/\text{m}^4\text{]}$

5. A velocity field is represented as  $\vec{V} = (1+t)\vec{x}_i + 2y\vec{j}$ . Is it a compressible or incompressible flow? Find the equation of the streamline which passes the point  $x=1$  and  $y=2$  at  $t=0$ . (15%)

6. Describe the characteristics of subsonic and supersonic flows. Draw the streamlines of (i) a subsonic and (ii) a supersonic flow over a thin airfoil shown below and give the reasons which cause these flow patterns. (15%)

