Assignment 04

We due date for submitting this assignment is 14th October 23:59 IST. As per our records you have not submitted this assignment.

1. Assuming linear velocity profile, \( \frac{u}{u_0} = \frac{x}{L} \), and using approximate momentum integral method, find the expression for boundary layer thickness \( \delta \).
   \[ \delta = \frac{2}{\sqrt{u_0}} \]

2. For boundary layer flow on wedge shaped body, what is the condition for 2D stagnation flow?
   \[ m = 0 \]
   \[ m = 0.5 \]
   \[ m = 1 \]
   \[ m = 2 \]

3. What is the non-dimensional equation obtained from the below given energy equation?
   \[ \frac{\rho}{\rho_0} \left( \frac{u}{u_0} \right)^2 + \frac{\rho}{\rho_0} \left( \frac{v}{v_0} \right)^2 + \frac{\rho}{\rho_0} \left( \frac{w}{w_0} \right)^2 = \frac{T}{T_0} \]
   \[ \frac{\rho}{\rho_0} \left( \frac{u}{u_0} \right)^2 + \frac{\rho}{\rho_0} \left( \frac{v}{v_0} \right)^2 + \frac{\rho}{\rho_0} \left( \frac{w}{w_0} \right)^2 = 0 \]
   \[ \frac{\rho}{\rho_0} \left( \frac{u}{u_0} \right)^2 + \frac{\rho}{\rho_0} \left( \frac{v}{v_0} \right)^2 + \frac{\rho}{\rho_0} \left( \frac{w}{w_0} \right)^2 = \frac{T}{T_0} \]
   \[ \frac{\rho}{\rho_0} \left( \frac{u}{u_0} \right)^2 + \frac{\rho}{\rho_0} \left( \frac{v}{v_0} \right)^2 + \frac{\rho}{\rho_0} \left( \frac{w}{w_0} \right)^2 = \frac{T}{T_0} \]

4. Assuming cubic temperature profile, \( T = \alpha x + \beta y + \gamma z \)

5. For a flow over an isothermal flat plate. Applying the boundary conditions for boundary layer flows express \( \Gamma \) in terms of \( \delta \) (thermal boundary layer).

6. For flow over a flat plate with uniform surface heat flux (shown in figure), assuming cubic velocity and cubic temperature profile, find the constant \( \alpha \) for the expression given below.

\[ \frac{T}{T_0} = \frac{1}{1 - \frac{x}{L}} \]