# Assignment - 2 :
## Boundary Layer

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1) Determine the displacement thickness and momentum thickness in terms of the nominal boundary layer thickness $\delta$ in respect of the following velocity profiles in the boundary layer on a flat plate.

i) $$\frac{u}{V_0} = 2\left(y/\delta\right) - \left(y/\delta\right)^2$$

ii) $$u/V_0 = \left(y/\delta\right)^{1/m}$$

where $u$ is the velocity at a height $y$ above the surface and $V_0$ is the free stream velocity.

2) Work out the following boundary layer parameters for the velocity distribution prescribed by
$$u/V_0 = \left(y/\delta\right)^{1/7}$$

i) ~~Dis~~ Displacement and momentum thickness and the shape factor

ii) Energy thickness.

further evaluate the energy loss due to boundary layer if at a particular section the boundary layer thickness is 3.0 cm and the free stream velocity is 12 m/sec. If discharge through the boundary layer region is 5 $m^3$/sec per metre width, express the energy loss in terms of meter of head. Take $\rho = 1.2\ kg/m^3$.

3) Atmospheric air at 25°C flows parallel to a flat plate at a velocity of 3 m/sec. Use the exact Blasius solution to estimate the boundary layer thickness and the local skin friction coefficient at $x = 1$m from the leading edge of the plate. How these values would compare with the corresponding values obtained from the approximate Von-Karman integral technique? Assume cubic velocity profile.

- for air at 25°C, $\nu = 15.53 \times 10^{-6}\ m^2/sec$.
- cubic velocity profile is

$$u/U_0 = \frac{3}{2}(y/\delta) - \frac{1}{2}(y/\delta)^3$$