# KATIHAR ENGINEERING COLLEGE, KATIHAR
# CIVIL ENGINEERING, 2nd Year (Semester-IV)

**Subject: Hydraulics & OCF** **Instructor: Rashid Mustafa**

## Assignment 1

**Q.1** Calculate the friction drag on a plate 0.15 m wide and 0.45 m long placed longitudinally in a stream of oil having a free stream velocity of 6 m/sec. Also find the thickness of boundary layer and shear stress at the trailing edge. Specific gravity of oil= 0.925 and kinematic viscosity = $0.9x10^{-4}$ $m^2$/sec.

**Q.2** Assume that shear stress distribution varies linearly in a laminar boundary layer, such that

$$\tau = \tau_0 \left(1 - \frac{y}{\delta}\right)$$

Calculate the displacement thickness and momentum thickness in terms of **δ**.

**Q.3** The velocity distribution in a laminar boundary layer over a flat plate is assumed as u = asinby + c where a, b, c are constants. Apply the appropriate boundary conditions and determine the velocity distribution law.

**Q.4** For a velocity profile the laminar boundary layer

$$\frac{v}{V} = \frac{3}{2}\left(\frac{y}{\delta}\right) - \frac{1}{2}\left(\frac{y}{\delta}\right)^3$$

Calculate

(a)Boundary layer thickness (b) Shear stress (c) Drag force (d) coefficient of drag in terms of $R_e$

**Q.5** A thin plate is moving in a direction parallel to its length in still air at a velocity of 4.0 m/s. The length of the plate is 0.5m and width is 0.6 m. Taking kinematic viscosity of air is $1.5x10^{-6}$ $m^2$/s and density of air is 1.25 kg/ *m*3. Calculate (a) the boundary layer thickness at the end of plate, (b) shear stress at 20cm from the leading edge and (c) Drag force on one side of the plate.