1. Please draw a figure of control volume applied to fluid flowing over one side of a flat plate and derive the equation for growth of the laminar boundary layer and for shear stress along a smooth flat based on the Prandtl assumption:

$$u/U = (3/2)(y/\delta)-(1/2)(y/\delta)^3$$

(20%)

2. In Fig. 2, the truncated cone has an angle $= 60^o$. How long dose it take to draw the liquid surface down from y = 15 ft to y = 2 ft? (20%)

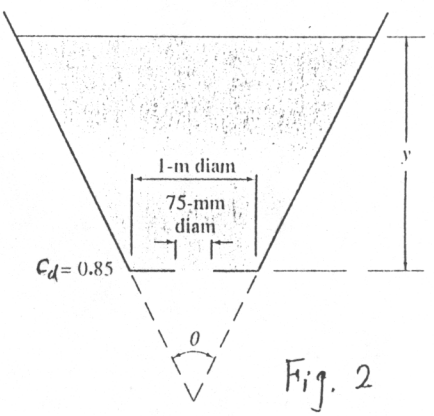

Fig. 2

3. Please draw a figure, derive the equation and describe the Numerical integration method to compute the gradually varied flow. (20%)

4. A flywheel weighing 970 N has a radius of gyration of 430 mm. When it is rotating at 790 rpm, its speed reduces 2 rpm/min owing to fluid viscosity between the sleeve and shaft. The sleeve length is 67 mm; shaft diameter is 33 mm; and radial clearance is 0.06 mm. Determine the fluid viscosity by the unit of cP. (20%)

5. Please draw a figure of Axial forces on a control volume in a conduit and derive the following equations:
   (a). Chézy Formula, (10%)
   (b). Darcy-Weisbach Equation (5%), and
   (c). Manning Formula. (5%)