1. Explain following terms :
   (a) Bernoulli equation(3%)
   (b) Venturi Tube (3%)
   (c) Lagrangian flow description method(3%)
   (d) Eulerian flow description method(3%)
   (e) stream function(3%)
   (f) velocity Potential(3%)
   (g) laminar flow(3%)
   (h) turbulent flow(3%)
   (i) Reynolds stress(3%)
   (j) Prandtl's mixing length theory(3%)

2. Answer as indicated :
   (a) Explain the physical meaning of (I) Reynolds number and (II) Froude number. (5%)
   (b) (i) Write down the Navier-Stokes equation in vector form. (ii) Explain the physical meaning of each term in (i). (5%)

3. A bathtub is being filled with water from a faucet. The rate of flow from the faucet is steady at 9gal/min. The tub volume is approximated by a rectangular space as indicated in Fig.1。(10%) (1 ft^3=7.48 gal)

   (a) Estimate the time rate of change of the depth of water in the tub.

   (b) How long would it take to fill the bathtub?

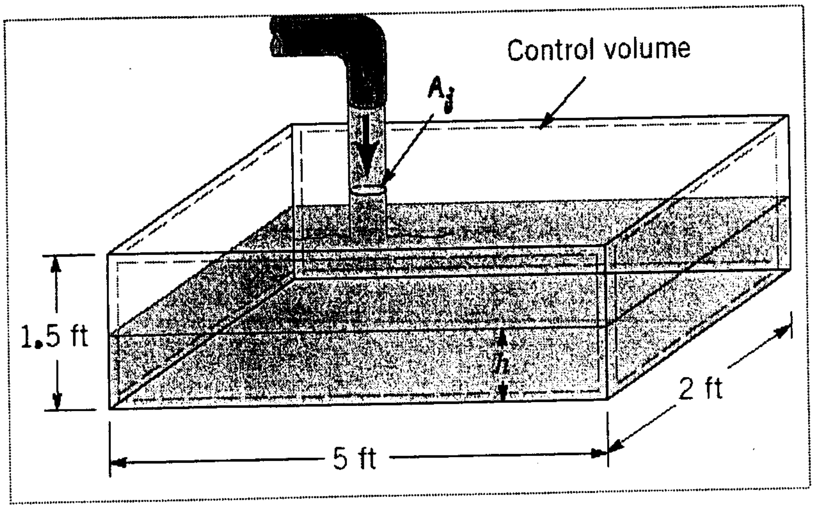

Fig. 1

（背面仍有題目,請繼續作答）

4. The drag, D, on a washer shaped plate placed normal to a stream of fluid can be expressed as $D = f(d_1, d_2, \mu, \rho, V)$ where d_1 is the outer diameter, d_2 is the inner diameter, V the fluid velocity, μ is the fluid viscosity, ρ is the fluid density. Some experiments are to be performed in a wind tunnel to determine the drag. What dimensionless parameters would you use to organize these data. (15%)

5. A body having the general shape of a half-body is placed in a stream of fluid. At a great distance upstream the velocity is U as shown in Fig.2. Show how a measurement of the differential pressure between the stagnation point and point A can be used to predict the free-stream velocity, U. Express the pressure differential in terms of U and fluid density. Neglect body forces and assume that the fluid is nonviscous and incompressible. (15%)

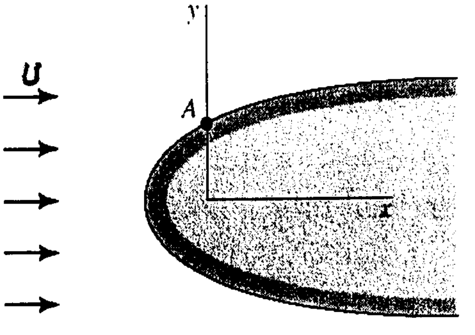

Fig. 2

6. A laminar boundary layer velocity profile is approximated by the two straight-line segments indicated in Fig. 3. Use the momentum integral equation to determine the boundary layer thickness, $\delta=\delta(x)$, and wall shear stress, $\tau_w = \tau_w(x)$. (20%)

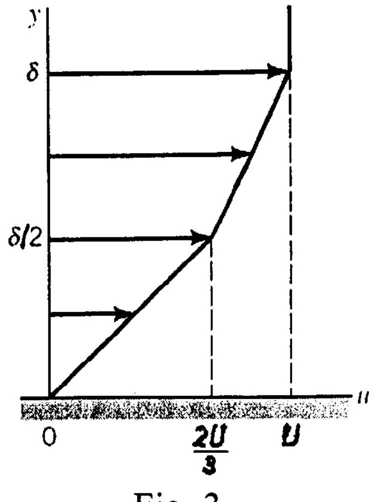

Fig. 3