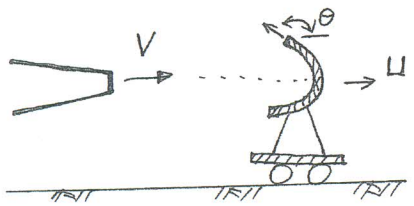
國立交通大學 100 學年度碩士班考試入學試題

科目：流體力學(3092)(3102)　　考試日期:100年2月17日 第 2 節

系所班別：土木工程學系　　組別：土木系丙組一般生、在職生　　第 1 頁，共 2 頁

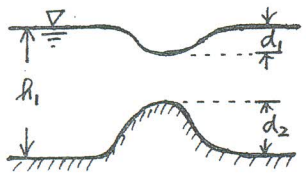
【可使用計算機】＊作答前請先核對試題、答案卷(試卷)與准考證之所組別與考科是否相符！！

1. Consider a single vane with turning angle, θ, moving horizontally at constant speed, U, as shown in Fig. 1. A jet of fluid with absolute velocity, V, strikes the vane. Assume the jet area is A
   (a) Find the force which is delivered to the vane. (10%)
   (b) Find the power which the vane could deliver under the action of the water jet. (5%)
   (c) Find the value of U/V to maximize the power delivered by the jet. (5%)



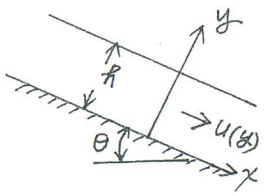
(Fig.1)

2. If the approach velocity is not too high, a bump in the bottom of a water channel causes a dip in the water surface which may serve as a flow rate measurement, as shown in the Fig. 2. If h_1=1m, d_1=10cm, d_2=10cm, what is the volumetric flow rate per unit width assuming no energy losses? (15%)



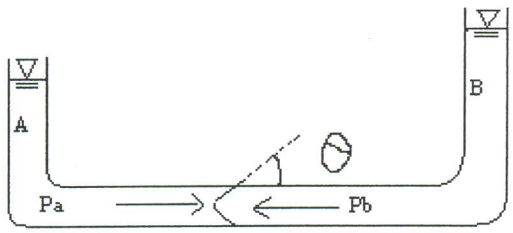
(Fig.2)

3. Consider the incompressible flow of a fluid of viscosity μ down an inclined plane, as shown in Fig. 3. Assume that the flow is steady, one-dimensional and the atmosphere exerts constant pressure and negligible shear on the free surface.
   (a) Draw a free body diagram for a fluid element (must include shear stresses and pressure forces). (5%)
   (b) Derive and expression for u(y) (10%)



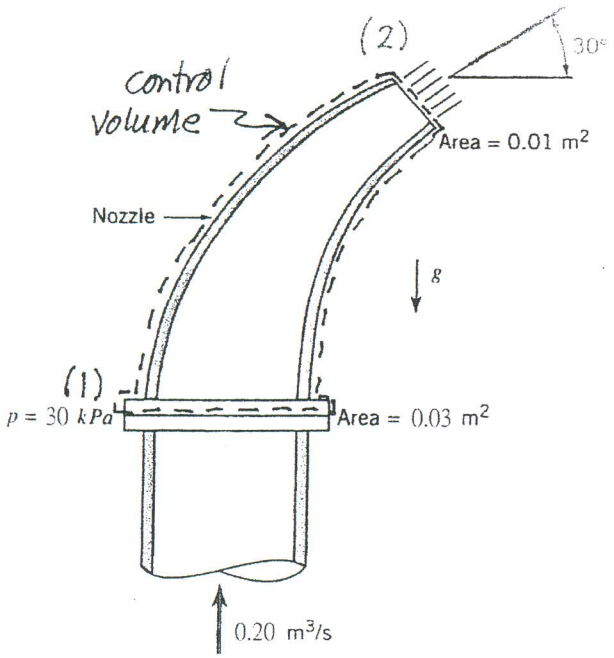
(Fig.3)

4. 如下圖(Fig. 4)所示一玻璃彎管兩端各注入互不相溶液體後之平衡狀態，其交界處將因界面張力而產生半圓形之交界面，其情形類似於吸管插入水中所形成之毛細管現象，若 A 液體之壓力為 83.4lb/ft^2，B 液體之壓力為 85lb/ft^2，σ=5.03×10^{-3}lb/ft(交界面之界面張力)、半徑 R=0.005ft，試求 θ=? (25%)



(Fig. 4)

5. A nozzle is attached to a vertical pipe and discharges water into the atmosphere as shown in Fig. 5. When the discharge is 0.2 m3/s, the gage pressure at the flange is 30 kPa. Determine the vertical component of the anchoring force required to hold the nozzle in place. The nozzle has a weight of 200 N, and the volume of water in the nozzle is 0.015 m^3. (25%)



(Fig. 5)