

# 國立成功大學

## 113學年度碩士班招生考試試題

編 號： 141

系 所： 環境工程學系

科 目： 流體力學

日 期： 0201

節 次： 第 2 節

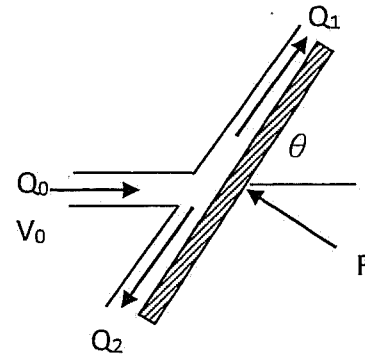
備 註： 不可使用計算機

※ 考生請注意：本試題不可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. A water jet (density =  $\rho$ ) issues from a long slot and strikes against a smooth inclined flat plate which is inclined at an angle ( $\theta$ ) as shown (no friction loss in the system)

(a) Calculate the  $Q_1$  and  $Q_2$  (expressed as  $Q_0$  and  $\theta$ ) (10%)

(b) Calculate the force ( $F$ ) required to hold the plate in stationary (expressed as  $Q_0$ ,  $V_0$  and  $\theta$ ) (10%)



2. A fluid flows through a pipe (radius =  $R$ ) in a laminar flow and its velocity distribution is shown as follow.

$$u = u_{\max} \left[ 1 - \left( \frac{r}{R} \right)^2 \right]$$

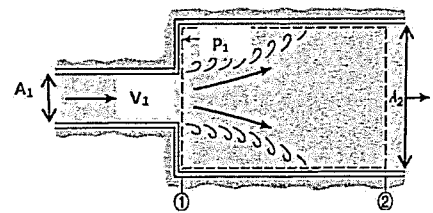
Please calculate

(1)  $u_{\text{ave}}$  (average velocity) and  $\alpha$  (kinetic energy correction factor) (10%)

(2)  $\beta$  (momentum correction factor) (10%)

3. A laminar boundary layer velocity profile is approximated by  $u/U = 2(y/\delta) - 2(y/\delta)^3 + (y/\delta)^4$  for  $y \leq \delta$ , and  $u = U$  for  $y > \delta$ . (a) show that this profile satisfies the appropriate boundary conditions; (b) use the momentum integral equation to determine the boundary layer thickness,  $\delta = \delta(x)$  (20%)

4. The sudden enlargement is shown in the following figure (the control volume is indicated by the dashed line). The pressure acting at section (1) is considered uniform with value  $P_1$ . Please derive the friction loss (20%)



5. A 3-m-wide, 8-m-high rectangular gate is located at the end of rectangular passage that is connected to a large open tank filled with water, as shown below. The gate is hinged at its bottom and held closed by a horizontal force ( $F_H$ ), located at the center of the gate. The maximum value of  $F_H$  is 3500 kN. (a) Determine the maximum water depth ( $h$ ) above the center of the gate that can exist without the gate opening. (b) How about  $h$  if the gate is hinged at the top? (20%)

