編號： 111

國立成功大學 104 學年度碩士班招生考試試題

系所組別：水利及海洋工程學系甲、乙組

考試科目：流體力學

考試日期：0211，節次：2

※ 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. (20 %) Consider a viscous fluid flows in laminar motion down an inclined plate at angle θ (Fig. 1). Assume the flow depth is constant. The velocity profile is $\tilde{u} = \alpha y(2h - y)$, $v = w = 0$. Find:
   (a) the constant α in terms of specific weight, viscosity and the angle θ;
   (b) the volume flux Q per unit width.

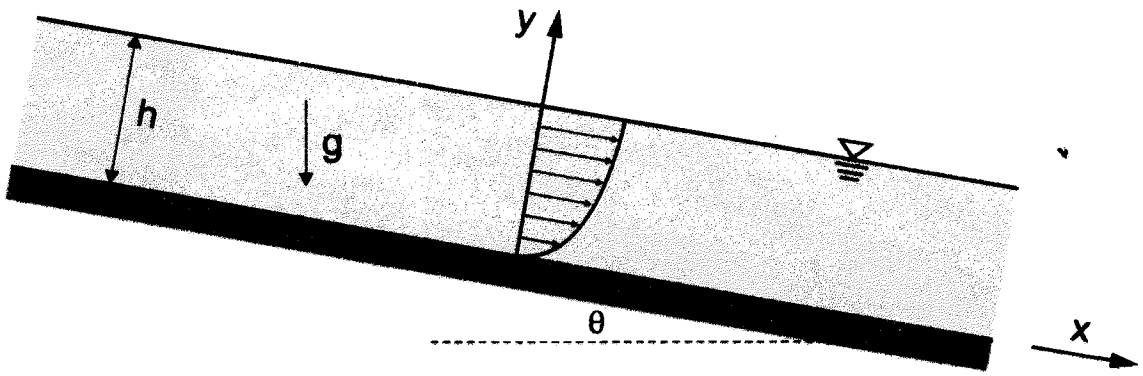

Figure 1

2. (12%) Find a relation between nozzle discharge velocity V_2 and tank free surface height h as in Fig. 2. Assure steady frictionless flow.

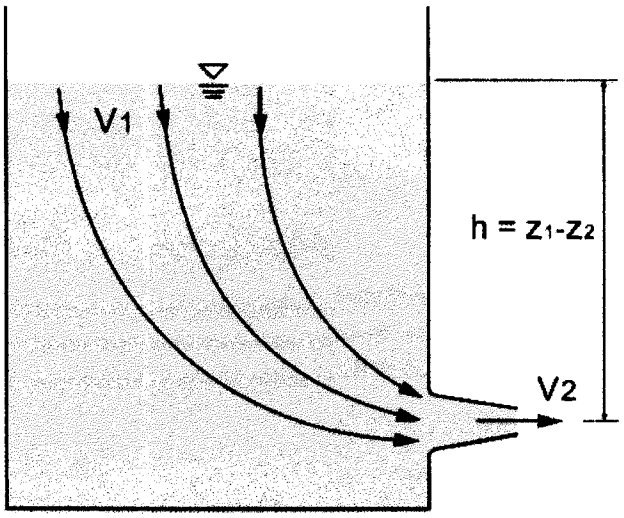

Figure 2

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3. (30 %) Consider a steady uniform laminar flow moving on a flat plate. The velocity profile is

$$\frac{u}{u_\infty} = a + b\left(\frac{y}{\delta}\right) + c\left(\frac{y}{\delta}\right)^2$$

where a, b, c are constants to be determined. Find:

(a) boundary thickness (δ)

(b) displacement thickness (δ^*)

(c) momentum thickness (θ)

(d) wall shear stress (τ_0)

(e) friction coefficient (C_f)

(f) drag coefficient (C_{Df})

4. (10%) Write down Navier-Stokes equation and explain the physical meaning of each term.

5. (28%) Explain shortly of the following terms. (Note: NOT just translation)

(a) Froude number and Reynolds number

(b) Bernoulli principle

(c) D'Alembert paradox

(d) material derivative

(e) Kármán vortex street

(f) source and sink

(g) boundary layer thickness