編號： 129 國立成功大學 105 學年度碩士班招生考試試題

系　　所：系統及船舶機電工程學系

考試科目：流體力學　　考試日期：0227，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%)

(1) (a) Write down equations that can describe streamlines.

(b) Let the fluid velocity be (u, v, w). Draw a picture for explaining the relation of the velocity and the streamlines.

(2) If u = x, v = 1, w = x, and one of its corresponding streamline passes through the point (1,0,0), find the streamline.

(3)(a) Can a particle path be a streamline ?

In what situation, a particle path is a streamline ?

(b) Explain the physical meaning of Df/Dt, where D/Dt denotes the substantial (or material) derivative and f (t, x, y, z) is the fluid property.

2. (20%)

The thrust developed to propel the jet ski don as shown is a result of water pumped through the vehicle and exiting as a high-speed water jet. For the conditions shown in the Fig.1, what flowrate is needed to produce a 1.3 kN thrust? Assume the inlet and outlet jets of water are free jets.

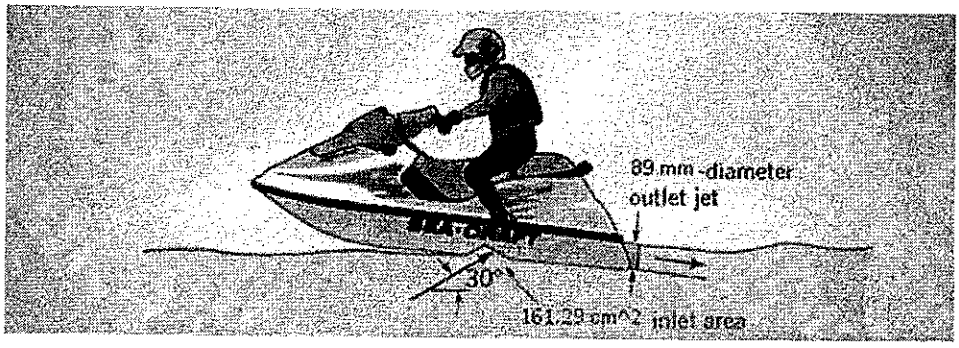

Fig. 1

3. (20%)

It is known that the velocity distribution for two-dimensional flow of a viscous fluid between wide parallel plates as shown is parabolic; that is, $U = Uo\left[1-\left(\frac{y}{h}\right)^2\right]$

With v =0. Determine, if possible, the corresponding stream function and velocity potential.

4. (20%)

The water flowrate, Q, in an open rectangular channel can be measured by placing a plate across the channel as shown in Fig. 2. This type of a device is called a weir. The height of the water, H, above the weir crest is referred to as the head and can be used to determine the flowrate through the channel. Assume that Q is a function of the head, H, the channel width, b, and the acceleration of gravity, g, . Determine a suitable set of dimensionless variables for this problem.

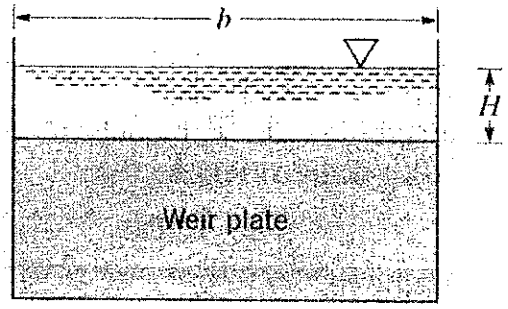

Fig. 2

5. (20%)

A laminar boundary layer velocity profile is approximated by $u/U=2(y/\delta)-2(y/\delta)^3+(y/\delta)^4$ for $y<=\delta$, 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, $\delta=\delta(x)$.