系所組別：系統及船舶機電工程學系甲組

考試科目：流體力學 考試日期：0222，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 the two-dimensional flow field defined by the following velocity components:

$$u = \frac{v}{1+t}, \quad v = 1, \quad w = 0$$

For this flow field find the equation of:

(a) The streamline through the point (1,1) at t=0

(b) The pathline for a particle released at the point (1,1) at t=0.

2. (20%)

A curved surface is formed as a circular arc with R = 0.75m as shown in Fig. 1. The surface width, W, is 1.0m.Water stands to the right of the curved surface to depth H = 0.65m.

(a) Find the vertical force exerted on the curved surface.

(b) Find the horizontal force exerted on the curved surface.

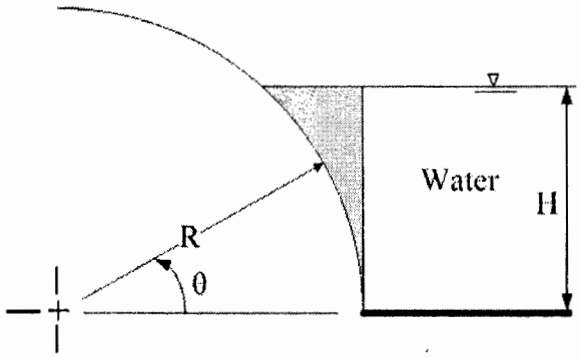

Fig. 1

3. (20%)

At a certain location wind is blowing steadily at 8 m/s. Determine the mechanical energy of air per unit mass and the power generation potential of a wind turbine with 50-m-diameter blades at that location. Also determine the actual electric power generation assuming an overall efficiency of 30 percent. Take the air density to be 1.25 kg/m^3.

(背面仍有題目,請繼續作答)

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4. (20%)

The velocity potential for a cylinder (Fig. 2) rotating in a uniform stream of fluid is $\Phi = Ur\left(1+\frac{a^2}{r^2}\right)\cos\theta + \frac{\Gamma}{2\pi}\theta$

where Γ is the circulation. For what value of the circulation will the stagnation point be located at: (a) point A; (b) point B?"

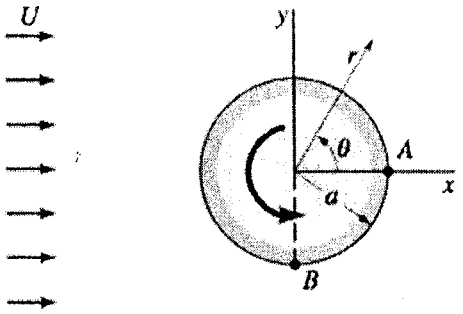

Fig. 2

5. (20%)

Show that the two-dimensional laminar-flow pattern with dp/dx= 0,

$$u = U_o(1 - e^{Cy}) \qquad v = v_0 < 0$$

is an exact solution to the boundary-layer equations. Find the value of the constant C in terms of the flow parameters. Are the boundary conditions satisfied? What might this flow represent?