國立中興大學 105 學年度碩士班招生考試試題

科目：流體力學　　系所：土木工程學系乙組

本科目可以使用計算機　　本科目試題共 2 頁

1. In a two-dimensional flow field $\overrightarrow{V} = (u, v)$ on the x-y (horizontal) plane, $u = x^2 - y^2 + 4$, $v = -2xy + 2$. (25%)

   (a) Is the flow incompressible? A proof is needed to get the credit. (5%)

   (b) Is the flow rotational? A proof is needed to get the credit. (5%)

   (c) As the density of fluid is equal to ρ and at location (0, 1) the pressure is 0, find the pressure at (1, 0). (7%)

   (d) Find the acceleration in the y-direction (a_y) at location (1, 1). (8%)

2. In a two-dimensional problem as shown in Fig. P2, water flows steadily over a block (ρ_{water} = 1000 kg/m^3). Sections ① and ② are far away from the block. By neglecting friction and the ground slope, evaluate the horizontal force on the block per unit width in N/m. (25%)

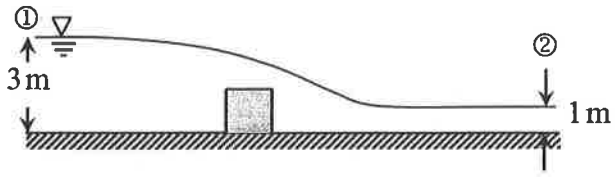

Fig. P2

3. As shown in Fig. P3, this abrupt expansion is to be used to dissipate the high-energy flow of water in the 1.5 m-diameter penstock (閘門). (25%)

   (a) What power (in kW) is lost through the expansion? (10%)

   (b) If the pressure at section 1 is 35 kPa gage, what is the pressure at section 2? (5%)

   (c) What force is needed to hold the expansion in place? (10%)

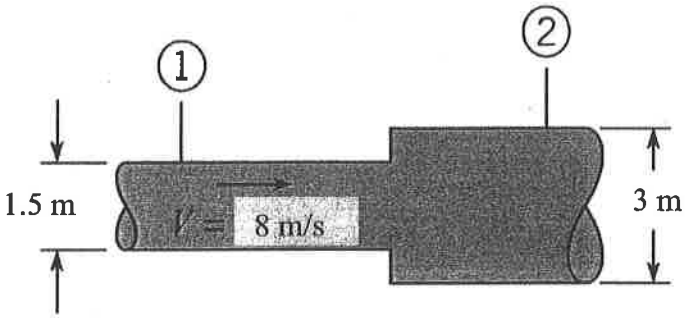

Fig. P3

　背面有題，請繼續作答。

4. As shown in Fig. P4, the velocity potential for a cylinder 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. (25%)

(a) Find the tangential velocity on the surface of the cylinder. (10%)

(b) Find the pressure difference between the top and the bottom of the cylinder. (10%)

(c) For what value of the circulation will the stagnation point be located at: (1) point A; (2) point B? (5%)

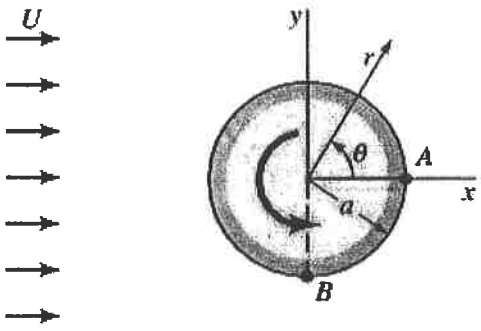

Fig. P4