

# 大同大學 九十二 學年度研究所碩士班入學考試試題

考試科目：流體力學

所別：機械工程研究所

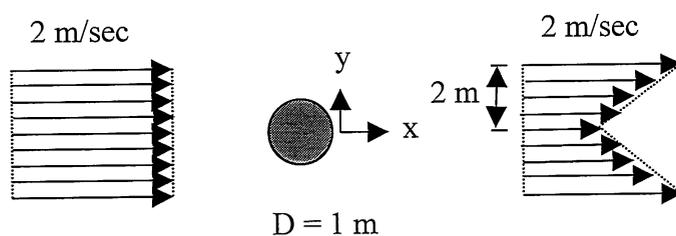
第1/2頁

註：本次考試 不可以參考自己的書籍及筆記； 不可以使用字典； 可以使用計算器。

- (10%) Define (a) displacement thickness, (b) hydraulic diameter, (c) stagnation pressure, (d) cavitation.
- (15%) Determine the maximum wall shear stress for fully developed laminar flow in a pipe of diameter  $D$  with fluid properties  $\rho$  and  $\mu$  given.
- (10%) The expression  $\mathbf{V} = 10x \mathbf{i} - 10y \mathbf{j}$  is said to represent the velocity vector for a two-dimensional incompressible flow.
  - Check it to see if it satisfies continuity.
  - Check it to see if it is irrotational.
- (15%) A two-dimensional incompressible flow is represented by the following stream function:
 
$$\phi(x,y) = x^3 - 3x^2 - 3xy^2 + 3y^2$$
  - Determine the equation of the streamline passing through the point (1,2).
  - Calculate the magnitude of velocity at the point (1,2).
  - Show that the direction of velocity is perpendicular to the direction of  $\nabla\phi$  at the point (1,2).
- (15%) A wind tunnel can deliver air at a maximum speed of 80 m/s. What is the span of a model plane when the prototype plane has a span 8 m and it is designed to fly at 90 mph?
- (10%) Oil with density of  $900 \text{ kg/m}^3$  and viscosity of  $0.01 \text{ N}\cdot\text{s}/\text{m}^2$  flows in a 400 m commercial steel pipe 0.2 m in diameter at a rate of  $0.3 \text{ m}^3/\text{s}$ . Determine the pressure drop along the pipe.

- (13%) 某橋柱的上游屬均勻流速  $\bar{v} = 2 \text{ m/sec} \hat{i}$  通過後流速  $\bar{v} = \begin{cases} (1 + \frac{y}{2})\hat{i}, & 0 \leq y \leq 2 \\ (1 - \frac{y}{2})\hat{i}, & -2 \leq y \leq 0 \end{cases}$

試求此橋柱之阻力係數  $C_D$  值。



<背面繼續>

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考試科目：流體力學

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第2/2頁

註：本次考試 不可以參考自己的書籍及筆記； 不可以使用字典； 可以使用計算器。

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8. (12%) 已知流場  $\vec{v} = Cy(2h - y)\hat{i}$ ，試由Navier-Stokes 方程式導出 C 值。其中  $C = f(\gamma, \mu, \theta)$ ， $\gamma$ ：比重量。並且再求取每單位長度(垂直紙面)之體積通量。

