110KA05

國立臺北科技大學 110 學年度碩士班招生考試

系所組別：1422 能源與冷凍空調工程系碩士班乙組

第二節　流體力學　試題（選考）

注意事項：

1. 本試題共 5 題，每題 20 分，共 100 分。
2. 不必抄題，作答時請將試題題號及答案依照順序寫在答案卷上。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

1. The venturi meter shown in Fig. 1 carries water at 60 °C (The specific weight $\gamma = 9.65$ kN/m^3). The specific gravity of the gage fluid in the manometer is 1.25. Calculate the velocity of flow at section A and the volume flow rate of water.

2. Water is added to the tank shown in Fig. 2 through a vertical pipe to maintain a constant (water) level. The tank is placed on a horizontal plane, which has a frictionless surface. Determine the horizontal force, F, required to hold the tank stationary. Neglect all losses.

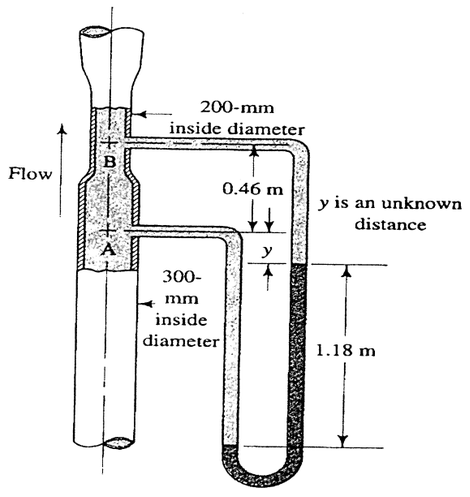

Fig. 1

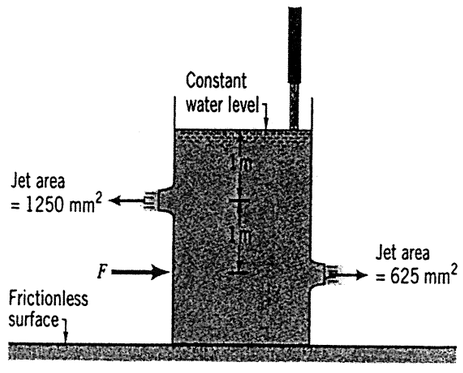

Fig. 2

3. Consider steady, incompressible, parallel, laminar flow of a viscous fluid falling between two infinite vertical walls, as shown in Fig. 3. The distance between the walls is h, and the gravity acts in the negative z-direction. There is no applied pressure driving the flow; that is, the fluid falls by gravity alone. The pressure is constant everywhere in the flow field. Calculate the velocity field.

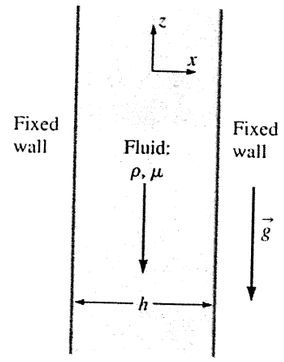

Fig. 3

4. Consider a two-dimensional laminar boundary-layer flow over a flat plate. Assume that the velocity profile is given by

$$\frac{u}{U} = a + by + cy^2$$

where U is the free stream velocity.

(a) Determine the constants a, b and c. (6%)

(b) Show that $\frac{\delta}{x} = \sqrt{\frac{C}{\mathrm{Re}_x}}$, where δ is the boundary-layer thickness and $\mathrm{Re}_x = \frac{Ux}{\nu}$. Also, please find C=? (10%)

(c) Show that local skin friction coefficient $C_{fx} = D/\mathrm{Re}_x^{1/2}$. Please find D=? (4%)

5. As shown in Fig. 4, a tank with fixed volume, ~~V~~, contains brine with initial density, ρ_i, greater than water. Pure water enters the tank steadily and mixes thoroughly with the brine in the tank. The liquid level in the tank remains constant. Derive expressions for (a) the rate of change of density of the liquid mixture in the tank, and (b) the time required for the density to reach the value ρ_f, where. $\rho_i > \rho_f > \rho_{H_2O}$

Note: A first-order linear differential equation: $y'(x) + p(x)y = q(x)$. Its solution is

$$y(x) = e^{-\int p(x)dx}\int\left(q(x)e^{\int p(x)dx}\right)dx + Ce^{-\int p(x)dx}$$

注意：背面尚有試題

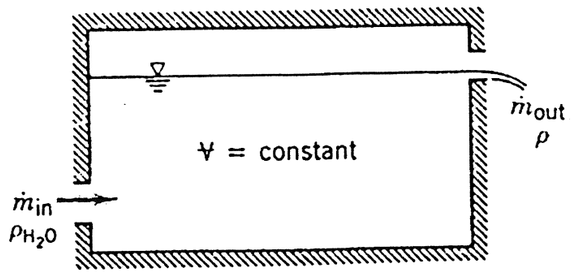

Fig. 4