

國立臺北科技大學九十九學年度碩士班招生考試

系所組別：1432 能源與冷凍空調工程系碩士班丙組

第二節 流體力學 試題 (選考)

第一頁 共一頁

注意事項：

1. 本試題共 5 題，配分共 100 分。
2. 請標明大題、子題編號作答，不必抄題。
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. Considering fluid flow in a fully-developed state as shown in Fig. 1, the axial velocity profile can be expressed by $u = (C/\mu)(h^2 - r^2)$, where C is a constant and h is the radius of the tube. If the tube diameter is 1 cm, $U_c = 30\text{m/s}$ and $\mu = 0.3\text{ kg/m}\cdot\text{s}$. Determine the wall shear stress in Pa. (15 分)

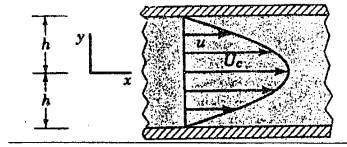


Figure 1

2. Considering the steady, incompressible, parallel, laminar flow of a viscous fluid falling between two infinite vertical walls as shown in Fig. 2, the distance between the walls is h , and gravity acts in the negative z -direction (i.e. downward in the figure). There is no applied pressure force driving the flow—the fluid falls by gravity alone. The pressure is assumed to be constant everywhere in the flowfield. Please derive an expression for the volume flowrate per unit width of fluid falling between two vertical walls as a function of ρ , μ , h and g . (25 分)

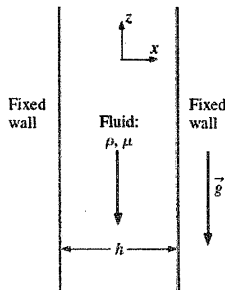


Figure 2

3. Figure 3 shows water flows through the pipe contraction. For a given 0.2-m difference in the manometer level, determine the flowrate as a function of the diameter of the small pipe, D . (20 分)

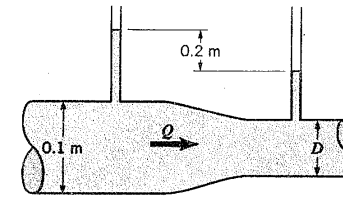


Figure 3

4. Considering water flows as two free jets from the tee attached to the pipe with the inflow cross sectional area of 1 m^2 shown in Fig. 4, the exit speed is 15 m/s with the outflow cross sectional areas of 0.3 and 0.5 m^2 , respectively. If the viscous effects and gravity are negligible, determine the x and y components of the force (F_x and F_y) that the pipe exerts on the tee. (20 分)

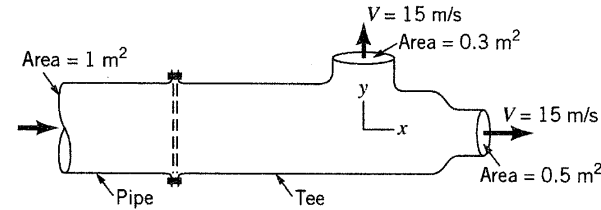


Figure 4

5. The pressure rise (Δp) across a pump can be expressed as $\Delta p = f(D, \rho, \omega, Q)$, where D is the impeller diameter, ρ the fluid density, ω the rotation speed, and Q the flowrate. Determine a suitable set of dimensionless parameters by the Buckingham π theorem. (20 分)