

國立臺北科技大學 105 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

第三節 流體力學 試題 (選考)

第一頁 共一頁

注意事項：

1. 本試題共【五】題，每題【20】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. Air flows from a pipe into the region between two parallel circular disks as shown in Fig. 1. The fluid velocity in the gap between the disks is closely approximated by $V=V_0R/r$, where R is the radius of the disk, r is the radial coordinate, and V_0 is the fluid velocity at the edge of the disk. Determine the acceleration for $r=2$, or 3 ft if $V_0=5$ ft/s and $R=3$ ft. (20分)

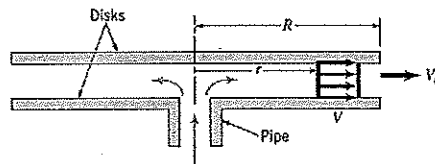


Figure 1

2. A water turbine wheel rotates at the rate of 50 rpm in the direction shown in Fig. 2. The inner radius, r_2 , of the blade row is 2 ft, and the outer radius, r_1 , is 4 ft. The absolute velocity vector at the turbine rotor entrance makes an angle of 20° with the tangential direction. The inlet blade angle is 60° relative to the tangential direction. The blade outlet angle is 120° . The flowrate is $20 \text{ ft}^3/\text{s}$. For the flow tangent to the rotor blade surface at inlet and outlet, determine an appropriate constant blade height, b , and the corresponding power available at the rotor shaft ($1 \text{ hp}=550 \text{ ft} \cdot \text{lb/s}$). (20分)

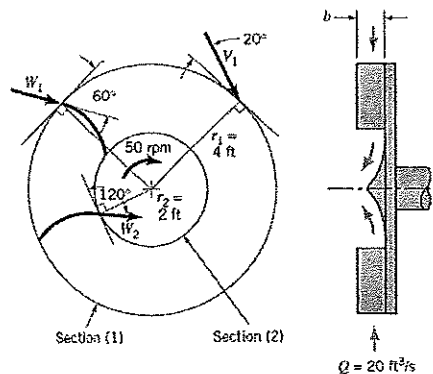


Figure 2

3. A viscous, incompressible fluid flows between the two infinite, vertical, parallel plates of Fig. 3. Determine, by use of the Navier-Stokes equations, an expression for the pressure gradient in the direction of flow. Express your answer in terms of the mean velocity. Assume that the flow is laminar, steady, and uniform.

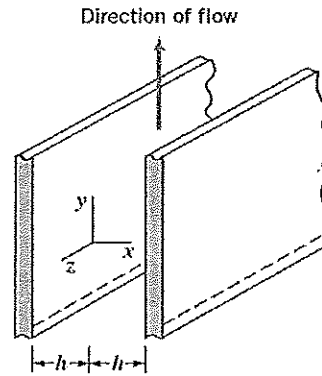


Figure 3

4. For a certain fluid flow problem it is known that both the Froude number and the Weber number ($= \rho V^2 \ell / \sigma$, where ρ : density, V : velocity, ℓ : length and σ : surface tension) are important dimensionless parameters. If the problem is to be studied by using a 1 : 15 scale model, determine the required surface tension scale if the density scale is equal to 1. The model and prototype operate in the same gravitational field.
5. The two flat plates shown in Fig. 4 are to have the same drag. Determine the upstream velocity U_b in terms of U_a and n . Assume laminar flow. Explain your answer physically.

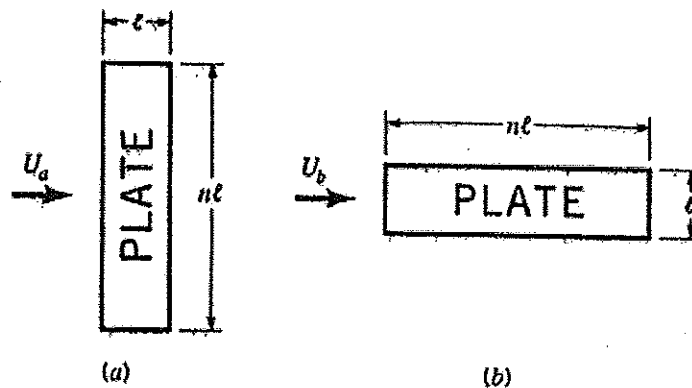


Figure 4