

# 國立臺北科技大學 108 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)

第一頁 共二頁

### 注意事項：

1. 本試題共五題，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. A thin 20cm×20cm flat plate is pulled at 1 m/s horizontally through a 3.6mm-thick oil layer sandwiched between two plates, one stationary and the other moving at a constant velocity of 0.3 m/s, as shown in Fig. 1. The dynamic viscosity of oil is 0.027 Pa·s. Assuming the velocity in each oil layer to vary linearly (a) plot the velocity profile and find the location where the oil velocity is zero (10分) and (b) determine the force that needs to be applied on the plate to maintain this motion. (10分)

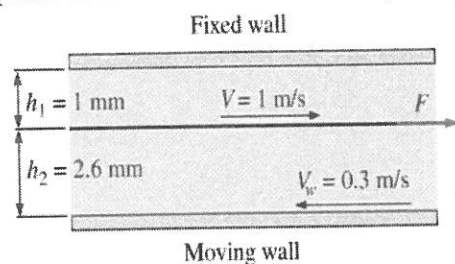


Figure 1

2. A water trough of semicircular cross section of radius 0.5m consists of two symmetric parts hinged to each other at the bottom, as shown in Fig. 2. The two parts are held together by a cable and turnbuckle placed every 3m along the length of the trough. Calculate the tension in each cable when the trough is filled to the rim. The density of water is 1000 kg/m<sup>3</sup> throughout. (20分)

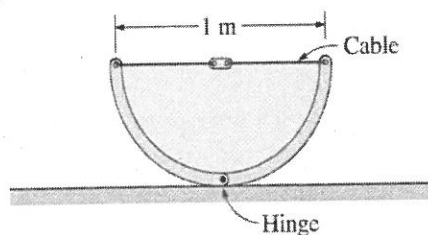


Figure 2

3. Water enters a tank of diameter  $D_T$  steadily at a mass flow rate of  $\dot{m}_{in}$ . An orifice at the bottom with diameter  $D_o$  allows water to escape (see Fig. 3). The orifice has a rounded entrance. So the frictional losses are negligible. If the tank is initially empty, (a) determine the maximum height that the water will reach in the tank (10分) and (b) obtain a relation for water height  $z$  as a function of time. (10分)

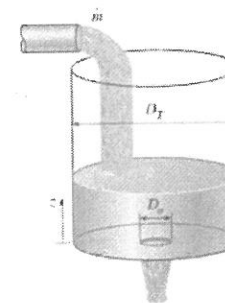


Figure 3

4. Commercially available large wind turbines (see Fig. 4) have blade span diameters as large as 100m and generate over 3 MW of electric power at peak design conditions. Consider a wind turbine with a 90m blade span subjected to 25-km/h steady winds. If the combined turbine-generator efficiency of the wind turbine is 32 percent, determine (a) the power generated by the turbine (10分) and (b) the horizontal force exerted by the wind on the supporting mast of the turbine. (10分) Take the density of air to be 1.25 kg/m<sup>3</sup>, and disregard frictional effects

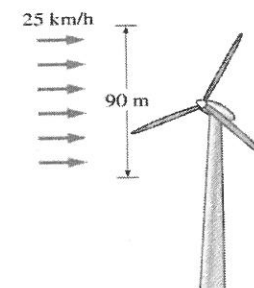


Figure 4

5. A certain part of cast iron piping of a water distribution system (See Fig. 5) involves a parallel section. Both parallel pipes have a diameter of 30cm, and the flow is fully turbulent. One of the branches (pipe A) is 1000m long while the other branch (pipe B) is 3000m long. If the flow rate through pipe A is 0.4m<sup>3</sup>/s. determine the flow rate through pipe B. Disregard minor losses and assume the water temperature to be 15°C. The density and dynamic viscosity of water at 15°C are  $\rho = 999.1 \text{ kg/m}^3$  and  $\mu = 1.138 \times 10^{-3} \text{ kg/m} \cdot \text{s}$ . (20分)

注意：背面尚有試題

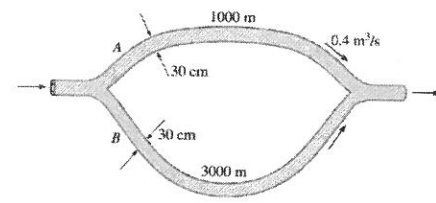


Figure 5