國立臺北科技大學 103 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

第三節　流體力學　試題（選考）

注意事項：

1. 本試題共五題，配分共 100 分。(每題 20 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. If a gently curved overflow structure placed in a high velocity flow produces the flowfield shown in Fig. 1 and if the indicated velocity distribution is assumed at section 2, what flowrate is indicated? (20分)

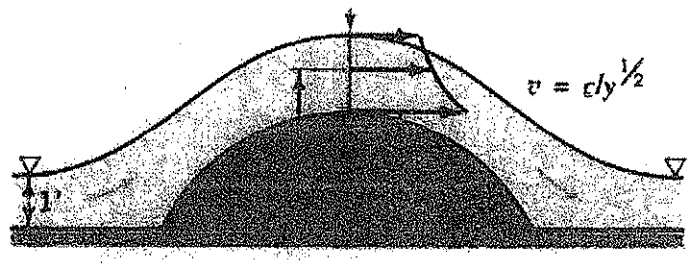

Figure 1

2. A single-stage axial-flow pump (shown in Fig. 2) takes water from a large reservoir. The pump has a hub diameter of 3 ft and a tip diameter of 4 ft, turns at 600 r/min, and delivers 300 ft^3/s of water. There are no inlet guide vanes. The trailing edge of the rotor blades makes an angle of 30° with the tangential direction. The trailing edge of the stator vanes is horizontal, i.e., it makes an angle of 90° with the tangential direction. Neglecting frictional effects, Calculate the static pressure change across the inlet, rotor, stator and diffusing case. Assume that there are enough closely spaced thin blades and vanes for the flow angles to correspond to the actual blade and vane angles. The specific weight of water is 62.4 lbf/ft^3.(20分)

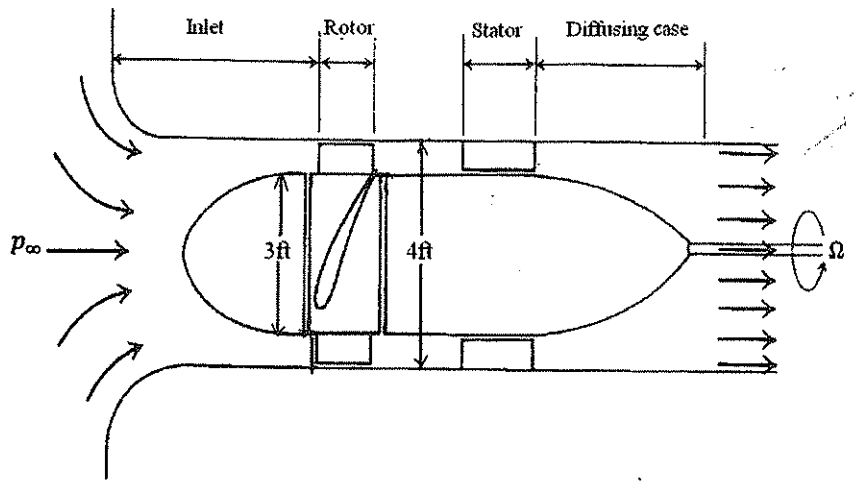

Figure 2

3. An axial compressor is intended to pump helium at 1200 r/min. A one-third-scale model is tested in air at 600 r/min and exhibits a flow rate of 6 m^3/s, a pressure rise of 145 Pa, and a power input of 1.0 kW. For dynamically similar conditions compute Q, Δp, and the power input for the prototype. Neglect Mach- and Reynolds-number effects and assume sea-level conditions. The densities of air and helium are $\rho_{air} = 1.20 kg/m^3$ and $\rho_{helium} = 0.167 kg/m^3$, respectively. (20分)

4. (a) According to Torricelli's theorem, the velocity of a fluid draining from a hole in a tank is $V \approx (2gh)^{1/2}$, where h is the depth of water above the hole and g is the gravitational acceleration, as in Fig. 3. Let the hole have area A_o and the cylindrical tank have bottom area A_b. Derive a formula for the time to drain the tank from an initial depth h_o in terms of A_o, A_b, h_o and g. (10分)

(b) The pipe flow in Fig. 4 fills a cylindrical tank as shown. At time t = 0, the water depth in the tank is 30 cm. Estimate the time required to fill the remainder of the tank. The density of water is $998 kg/m^3$.(10分)

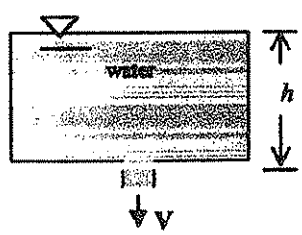

Figure 3

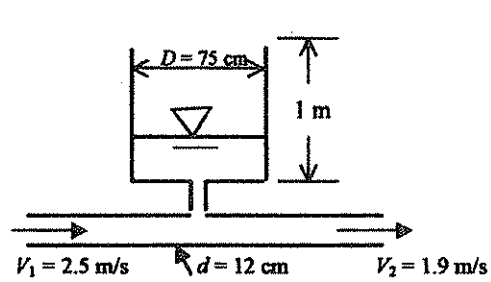

Figure 4

注意：背面尚有試題

5. Coal oil at 20°C flows through the pump in Fig. 5 at 2.3 ft^3/s. Head losses between 1 and 2 are 8 ft, and the pump delivers 8 hp to the flow. What should the mercury-manometer reading *h* ft be? For coal oil take γ_c(specific weight)=50.2 lbf/ft^3. For mercury take γ_m= 846 lbf/ft^3, and 1hp=550 ft·lbf/s. (20分)

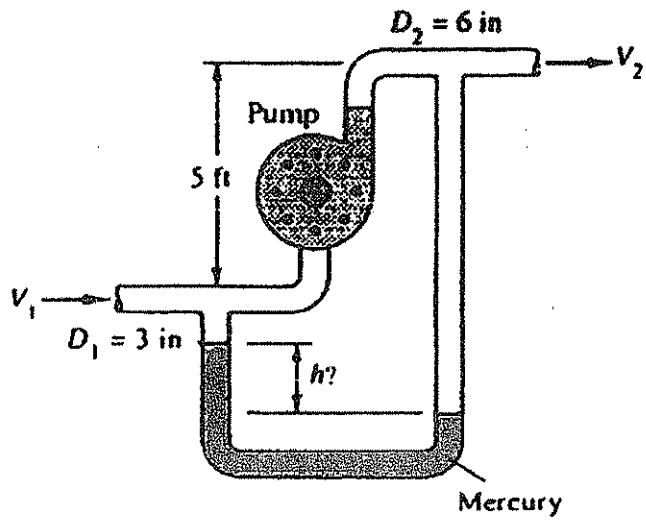

Figure 5