國立雲林科技大學 104 學年度
碩士班招生考試試題

系所：機械系
科目：流體力學(1)

1. In addition to the customary horizontal velocity components of the air in the atmosphere, there often are vertical air currents shown in Figure 1. Assume that the velocity in a certain region is approximated by $u = u_0$, $v = v_0 (1 - y/h)$ for $0 < y < h$, and $u = u_0$, $v = 0$ for $y > h$. Determine the equation for the streamlines and plot the streamline pass through the origin for values u_0/v_0 = 0.5, 1.0 , 2.0. **25%**
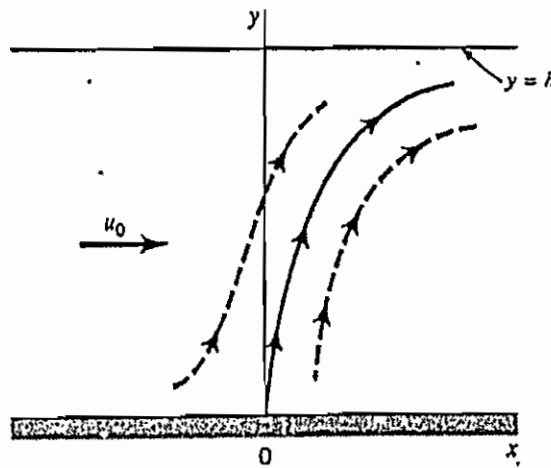

Figure 1.

2. Air flows steadily between two cross sections in a long, straight section of 0.25-m inside diameter pipe. The static temperature and pressure at each section are indicated in Figure 2. If the average air velocity at section (2) is 320m/sec, determine the average velocity at section (1). **25%**
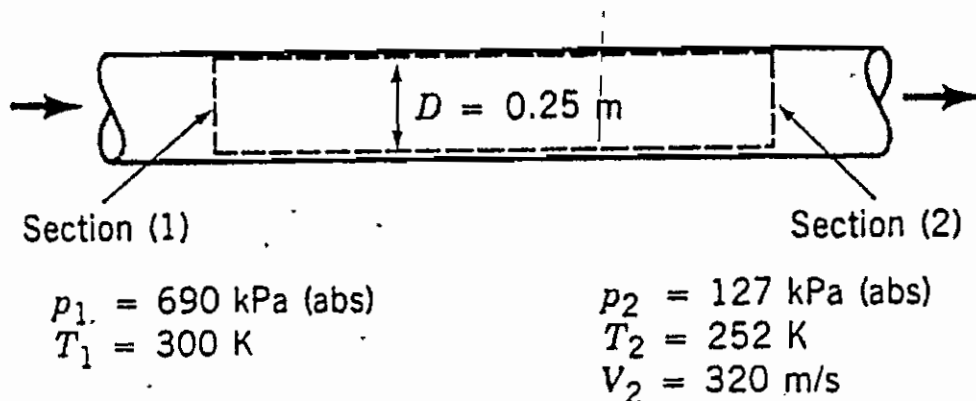

Section (1)

Section (2)

p_1 = 690 kPa (abs)
T_1 = 300 K

p_2 = 127 kPa (abs)
T_2 = 252 K
V_2 = 320 m/s

Figure 2.

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3. (25%) A hydrometer is a device for indicating the specific gravity of liquids. The figure below shows the design for a hydrometer in which the bottom part is a hollow cylinder with a 25.4 mm diameter, and the top is a tube with a 6.4 mm diameter. The empty hydrometer weighs 0.088 N. a) What weight of steel should be added to make the hydrometer float in the position shown in fresh water? b) What will be the specific gravity of the fluid in which the hydrometer would float at the top mark?
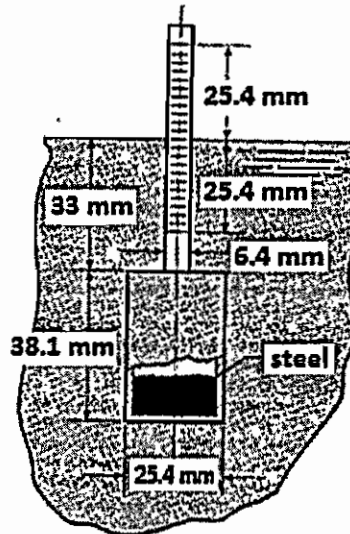
4. (25%) For the system shown, kerosene (sg=0.82) is to be forced from tank A to reservoir B by increasing the pressure in the sealed tank A above the kerosene. The total length of 2-in Schedule 40 steel pipe is 38 m. Calculate the required pressure in tank A to cause a flow rate of 435 L/min. (the inner diameter of the 2-in steel pipe is 0.0525 m, friction factor f for the pipe is 0.0222, loss coefficients for entrance, check valve, angle valve, elbow and exit are 1, 1.9, 2.85, 0.57 and 1, respectively. Density of water is 1000 kg/m^3 and g = 9.81m/s^2)