國立中山大學100學年度碩士班招生考試試題

科目：流體力學【海下海物所碩士班選考】

1. (40%; 5% each) *Define* and *explain* the following terms（定義並解釋下列名詞）:
   (a) Reynolds stress
   (b) Velocity potential
   (c) Steady state fluid flow
   (d) Doppler effect
   (e) Barotropic fluid
   (f) Boundary layer
   (g) Dynamic similarity
   (h) Streakline

2. (10%) Consider the Bernoulli equation: $\frac{p}{\rho}+\frac{v^2}{2}+gz=$ constant, where p, ρ, v, g are the pressure, density, speed, gravity constant, respectively; z is the vertical coordinate pointing upwards. List the assumptions that have to be made so that this Bernoulli equation is applicable.

3. (15%) A spillway gate formed in the shape of a circular arc is w meter wide, as shown in Figure 1. Find the magnitude and line of action of the vertical component of the force due to all fluids acting on the gate.

4. (15%) Consider a 30° reducing elbow as shown in Figure 2. The fluid is water. Evaluate the components of force that must be provided by the adjacent pipes to keep the elbow from moving.

5. (20%) Consider a fluid flow that may be described by the following equation:

$$\frac{d\mathrm{v}}{dt}=-\frac{1}{\rho}\nabla p+\mathrm{g}$$

where v, p, g, ρ are velocity, pressure, gravitational force, and density, respectively.
   (a) What are the assumptions that have to be made so that the above equation is valid? (5%)
   (b) Show that, if the flow starts irrotationally, then it remains irrotational all the time. (15%)

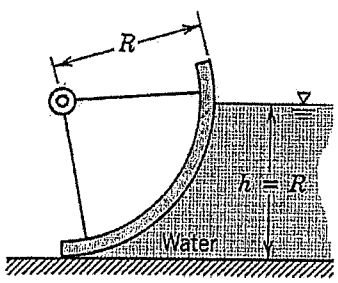

Figure 1

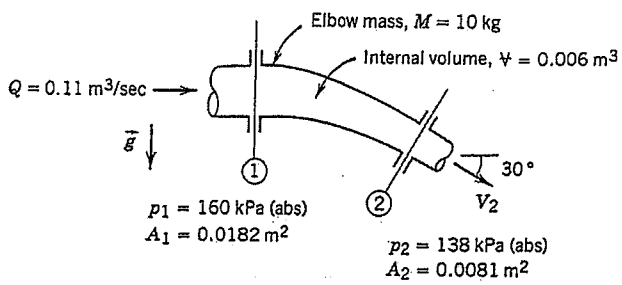

Figure 2