國立中央大學 106 學年度碩士班考試入學試題

所別： 水文與海洋科學研究所 碩士班 不分組(一般生)　　共 1 頁 第 1 頁

科目： 流體力學

本科考試禁用計算器　　＊請在答案卷內作答

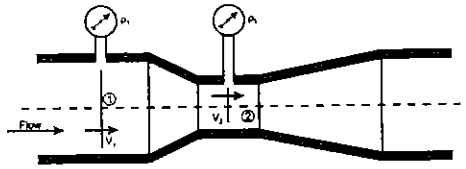
（可用中文答題）　須有計算過程

參考用

1. (20%) What are the four assumptions of Bernoulli's equation?

2. Considering a rectangular channel. The width is B and the flow depth is d. The velocity distribution is u=ky in which k is a constant, and y is the vertical distance from the channel bottom. Please calculate:
   (1) Mean velocity (15%)
   (2) Froude number (10%).

3. (20%) Figure shows a Venturi meter with pressure p_1 and p_2 section 1 and 2. Assuming the cross-session area are A1 and A2, please derive the equation for the volume flow rate in terms of p_1, p_2, A1, and A2.



4. Given the stream function of a 2D flow field

$$\psi = U_0\left(1-\frac{x}{L}\right)y$$

$$U_0 = At$$

Where the constant A has dimension m/s^2, t is time and L is a given length.

(1) (10%) Calculate the velocity components u and v, where

$$u = \frac{\partial \psi}{\partial y}\ ,\ v = -\frac{\partial \psi}{\partial x}$$

(2) (10%) Show that the flow is irrational, In which $\omega_z = \frac{\partial v}{\partial x} - \frac{\partial u}{\partial y}$

(3) (15%) Calculate the x-component of the material time derivative $\frac{Du}{Dt}$ in Eulerian coordinates, in which

$$\frac{Du}{Dt} = \frac{\partial u}{\partial t} + u\frac{\partial u}{\partial x} + v\frac{\partial v}{\partial y}$$