90 年博士班資格考　流力試題 (一)

1. The velocity distribution for the flow of a Newtonian fluid between two wide, parallel plates(Fig.1) is given by the equation

$$u = \frac{3V}{2}\left[1-\left(\frac{y}{h}\right)^2\right]$$

where V is the mean velocity. The fluid has a viscosity of 0.04 lb.s/ft^2. When V=2ft/s and h=0.2 in. determine: (a) the shearing stress acting on the bottom wall, and (b) the shearing stress acting on a plane parallel to the walls and passing through the centerline (midplane) (10%). Explain and define the Newtonian fluids and non-Newtonian fluids. (5%)

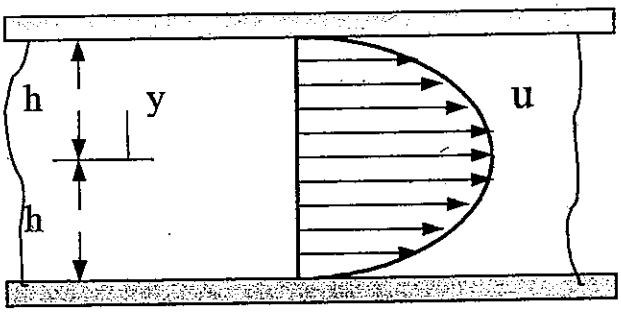

Fig. 1

2. Based on what assumptions? the Bernoulli equation are approximately valid. (5%). And define the static, stagnation, hydrostatic, dynamic and total pressure in Bernoulli equation. (5%). Knowledge of the values of static and stagnation pressures in a fluid implies that the fluid speed can be calculated. This is the principle on which the ***Pitot-static tube*** is based. As shown in Fig.2 explain the where are the static and stagnation pressures, and define the velocity of the fluid upstream by pressure difference and density. (10%)

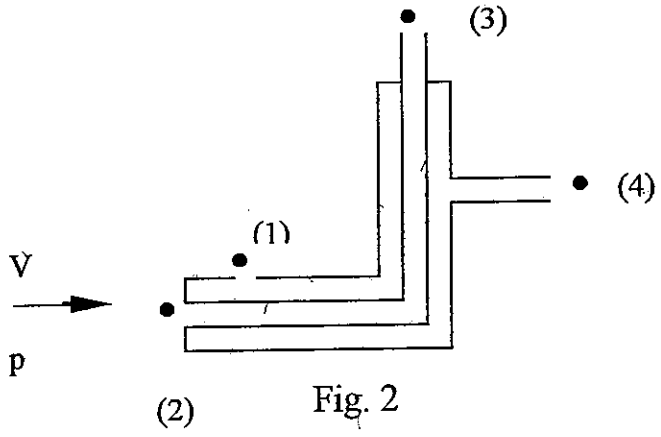

Fig. 2

3. what is the streamline?, For two dimensional, steady flow, use a equation to define the streamline. (5%). Determine the streamlines and stream function for the two-dimensional steady flow of velocity, $V = (V_o / \ell)(x\,\hat{i} - y\,\hat{j})$, and Plot the streamlines in two dimensional plane for $\psi = 1$, 4 and 9 (10%)

Fluid Mechanics Qualify Exam (Part II)

1. Please Explain (20%)

(a) Flow separation (5%)

(b) Moody Chart (5%)

(c) Laminar and turbulent boundary layer (10%)

2. Derive the expression of the velocity profile for the Couette flow (15%)

3. Please derive the Navier Stokes equations and list the assumptions (15%)