國立成功大學

113學年度碩士班招生考試試題

編　號：150

系　所：生物醫學工程學系

科　目：流體力學

日　期：0201

節　次：第 2 節

備　註：可使用計算機

編號： 150

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※ 考生請注意：本試題可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. Define the following terms: (20%)

(a) Laminar flow and turbulent flow

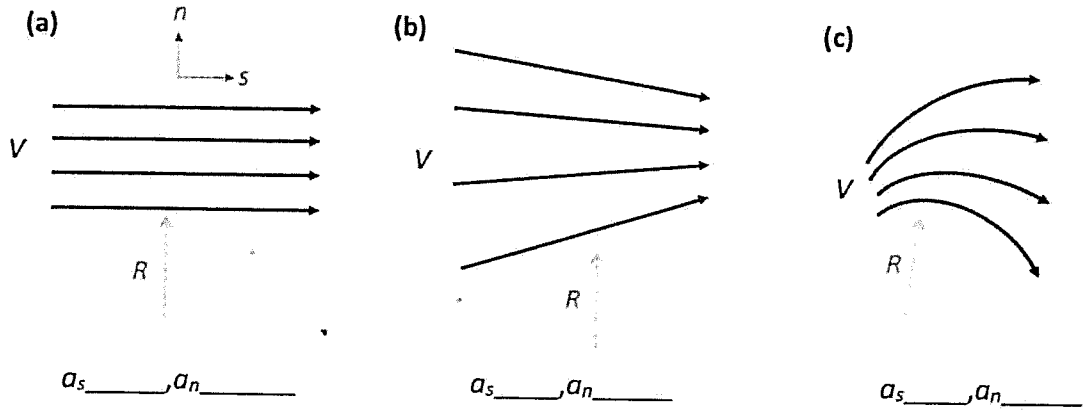
(b) Surface tension

(c) Dynamic viscosity and kinematic viscosity

(d) Control volume

(e) Head loss

2. a_s and a_n represent the accelerations along and normal to the streamlines, respectively. Indicate their values (a=0, a>0, a<0) in the following flow conditions. (15%) (Hint: $a_s = V\frac{\partial V}{\partial s}$, $a_n = \frac{V^2}{R}$)



a_s_____,a_n_____　　a_s_____,a_n_____　　a_s_____,a_n_____

3. Oil flows through the 100-mm-diameter pipe with a velocity of 5 m/s (Fig. 1). If the pressure in the pipe at *A* and *B* is 80 kPa, determine the *x* and *y* components of force the flow exerts on the elbow. The flow occurs in the horizontal plane. Take ρ_o = 900 kg/m^3. (Notice: A control volume needs to be shown) (16%)

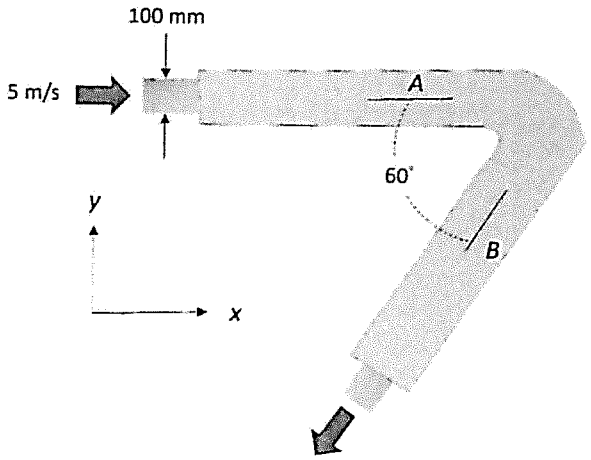


Fig. 1

4. Given a combined uniform flow of 8 m/s and a source having a strength of 3 m^2/s (Fig. 2).

(a) Write down a stream function for the flow (5%)

(b) Determine the velocities u and v in terms of r and θ (6%)

(C) Determine the location of the stagnation point (8%)

(d) Plot the streamline passing through the stagnation point. (4%)

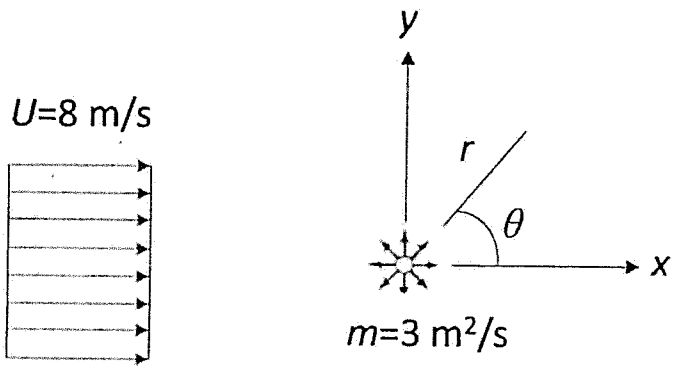


Fig. 2

5. The laminar flow of a two-dimensional fluid has velocity components $u = 6x$ and $v = -6y$, which is steady and incompressible. Given the density of the fluid is 1 and the gravity is negligible. Use the given Navier–Stokes equations below to

(a) Draw the streamlines of the flow (6%)

(b) Determine if the flow rotational or irrotational? (5%)

(c) Determine the pressure in the fluid, $p = p(x, y)$, if at point (0, 0), $p = 0$ (15%)

$$\rho\left(\frac{\partial u}{\partial t}+u\frac{\partial u}{\partial x}+v\frac{\partial u}{\partial y}\right)=-\frac{\partial p}{\partial x}+\mu\left[\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}\right]+\rho g_x$$

$$\rho\left(\frac{\partial v}{\partial t}+u\frac{\partial v}{\partial x}+v\frac{\partial v}{\partial y}\right)=-\frac{\partial p}{\partial y}+\mu\left[\frac{\partial^2 v}{\partial x^2}+\frac{\partial^2 v}{\partial y^2}\right]+\rho g_y$$