淡江大學九十二學年度碩士班招生考試試題

系別：機械與機電工程學系　　科目：流 體 力 學

准帶項目請打「○」否則打「×」
○ 簡單型計算機

一、 選擇題 (40%)

1. Which of the following sets of equations represent possible two dimensional incompressible flow cases ?
(a) $u = x + y$; $v = x - y$ (b) $u = x + 2y$; $v = x^2 - y^2$ (c) $u = 4x + y$; $v = x - y^2$ (d) $u = xt + 2y$; $v = x^2 - yt^2$

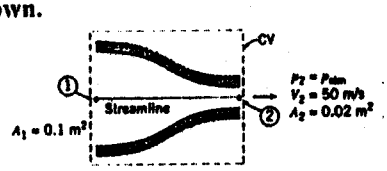
2. If $\psi(x, y, t)$ called the stream function, is defined such that
(a) $u = \frac{\partial \psi}{\partial x}, v = \frac{\partial \psi}{\partial y}$ (b) $u = \frac{\partial \psi}{\partial y}, v = \frac{\partial \psi}{\partial x}$ (c) $u = \frac{\partial \psi}{\partial y}, v = -\frac{\partial \psi}{\partial x}$ (d) $u = \frac{\partial \psi}{\partial x}, v = -\frac{\partial \psi}{\partial y}$

3. Which of the following statement about stream function ψ is <u>not</u> true?
(a) ψ is a constant along a streamline (b) The differential of ψ is exact
(c) $\psi_2 - \psi_1$, depends only on the end points of integration (d) ψ is a path function

4. For steady flow in a horizontal plane, Euler's equation normal to a streamline is $\frac{1}{\rho}\frac{\partial P}{\partial n} = \frac{V^2}{R}$, in regions where streamlines are straight, which is true?
(a) The radius of curvature R is finite (b) No pressure variation normal to the streamlines
(c) The pressures increase in the direction outward from the center (d) The flow is incompressible

5. Which is <u>not</u> true for $h_{lm} = K\frac{\bar{V}^2}{2} = f\frac{L_e}{D}\frac{\bar{V}^2}{2}$
(a) h_{lm} is major loss (b) K is loss coefficient (c) f is friction factor
(d) L_e is an equivalent length of straight pipe

6. Water flow through a nozzle, as shown.



Find $p_1 - p_{atm}$, for water, $\rho = 1000\ kg/m^3$ (apply Bernoulli eqn)
(a) 1.48 kpa (b) 14.8 kpa (c) 120.3 kpa (d) 1203.3 kpa

7. For drawn tubing, $e = 5\times10^{-6}$ ft, D = 1.5 in, $\bar{V} = 46.1\ ft/s$, $\nu = 1.05\times10^{-5}\ ft^2/s$, What is friction factor f from the figure?
(a) 0.01 (b) 0.013 (c) 0.018 (d) 0.021

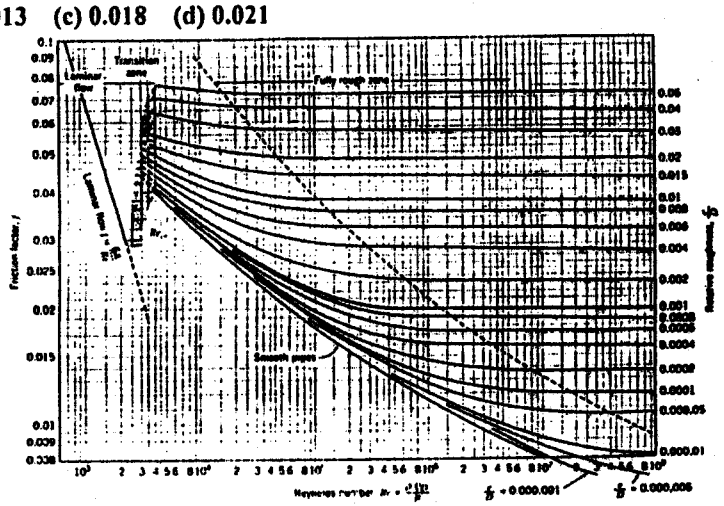


Fig. 8.13 Friction factor for fully developed flow in circular pipes. (Data from [8], used by permission.)

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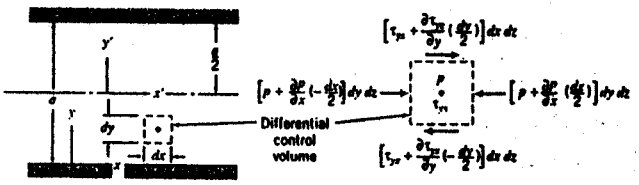
8. Which is not the restriction for Bernoulli equation ?
   (a) steady flow (b) incompressible flow
   (c) uniform flow (d) frictionless flow

9. For incompressible flow , Mach number
   (a) M≤ 0.2 (b) M≥ 0.2 (c) M≥ 0.3 (d) M≤ 0.3

10. For fully developed laminar flow, between infinite parallel plates,
    The plates are separated by distance a, shown in Fig. 8.2, which is <u>not</u> true?
    (a) at $y=\frac{a}{2}$, $u=U_{max}$ (b) $u_{max}=\frac{1}{2}\bar{v}$ (c) at $y=0$, $u=0$ (d) at $y=a$, $u=0$

二、 Please derive the velocity profile u for the fully developed laminar flow between infinite parallel plates. (20%)



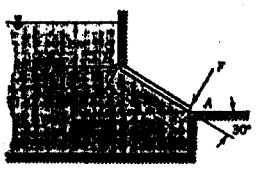
(a) Geometry of CV　　(b) Forces acting on CV

Fig. 8.2 Control volume for analysis of laminar flow between stationary infinite parallel plates.

三、 The gate shown is hinged at H. The gate is 2 m wide normal to the plane of the diagram. Calculate the force required at A to hold the gate closed. (20%)

($F_R=p_cA$, $y'=y_c+\frac{I_{xx}}{y_cA}$,

$I_{xx}=\frac{bL^3}{12}$) (20%)



四、 A jet of water issuing from a stationary nozzle at 15m/s (A_J = 0.05 m^2) strikes a turning vane mounted on a cart as shown. The vane turns the jet through angle $\theta=60°$
Determine the vane of M required to hold the cart stationary. (20%)