

國立成功大學

115學年度碩士班招生考試試題

編號：103

系所：環境工程學系

科目：流體力學

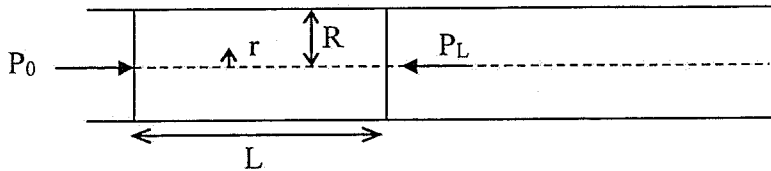
日期：0203

節次：第 2 節

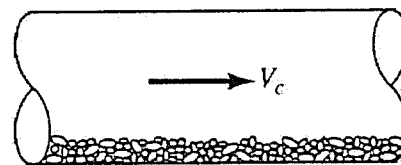
注意：1. 不可使用計算機
2. 請於答案卷(卡)作答，於
試題上作答，不予計分。

1. An incompressible laminar flow (viscosity μ) in a circular conduit is depicted in the following Figure. Please derive

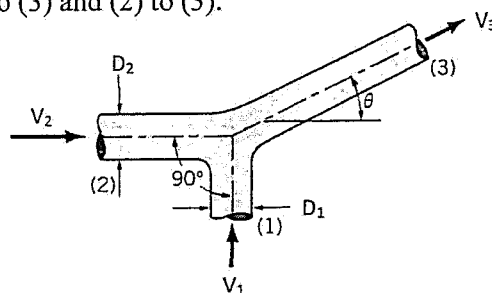
- (1) Shear stress (τ) as function of r (5%)
- (2) Volume flowrate (\dot{V}) as function of R (5%)
- (3) Draw the shear stress and velocity profile (5%)
- (4) Energy correction factor (α) (10%)



2. A thin layer of particles rests on the bottom of a horizontal tube as shown below. When an incompressible fluid flows through the tube, it is observed that at some critical velocity, the particles will rise and be transported along the tube. A model is to be used to determine the critical velocity. Assume the critical velocity, V_c , to be a function of the pipe diameter, D , particle diameter, d , the fluid density, ρ , and the viscosity, μ , the density of the particles, ρ_p , and the acceleration of gravity, g . (a) Determine the similarity requirements for the model and the relationship between the critical velocity for model and prototype (the prediction equation) (b) For a length scale of $1/4$ and a fluid density scale of $1/1$, what will be the critical velocity scale? (assuming all similarity requirements are satisfied) (25%).



- 3. Two water (density = ρ) jets collide and form one homogeneous jet as shown below. Gravity is negligible.
 - (a) Determine the direction (θ) (please express as V_1, V_2, D_1 and D_2) and speed (V_3) (please express as θ, V_1, V_2, D_1 and D_2) (15%)
 - (b) Determine the loss for a fluid particle flowing from (1) to (3) and (2) to (3). (please express as ρ, V_1, V_2, V_3, D_1 and D_2) (10%)



4. A structure is attached to the ocean floor as shown. A 2 m diameter hatch is located in an inclined wall and hinged on one edge. Determine the minimum air pressure (P_1) within the container that will open the hatch. Neglect the weight of the hatch and the friction in the hinge. ($\rho_{\text{sea water}} = 1030 \text{ kg/m}^3$) (25%)

