94 學年度 工程與系統科學系（所） 乙 組 碩士班入學考試

科目 流體力學 科目代碼 3303 共 2 頁第 1 頁 *請在試卷【答案卷】內作答

1. (12%) Verify the dimensions, in both the FLT and MLT systems, for

   (a) angular velocity

   (b) pressure head

   (c) surface tension

   (d) friction factor

   (e) dynamic viscosity

   (f) mass flow rate

2. (20%) Define the following terms and give physical meanings, please write down equations and/or plot diagrams to illustrate if they help

   (a) Reynolds number

   (b) inviscid flow

   (c) irrotational flow

   (d) Non-Newtonian fluid

   (e) Couette flow

   (f) hydraulic diameter

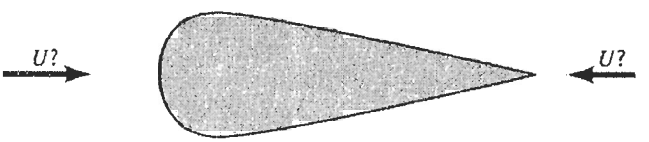
   (g) Boussineq approximation

   (h) boundary layer thickness

   (i) turbulent flow

   (k) no slip condition

(20%)What is boundary layer separation, and how does it occur? Are the separation phenomena different in laminar and turbulent boundary layers? How does it affect the drag coefficient? Is the drag on the object shown less when the wind blows from right to left than when it blows from left to right? Explain.



4 (15%) Please derive the Bernoulli equation by integrating **F**=m**a** along a streamline and name all the assumptions/restrictions using Bernoulli equation

5 (15%) The pressure drop, Δp, for steady, incompressible viscous flow through a straight horizontal pipe depends on the pipe length, ℓ, the average velocity, V, the viscosity, μ, the pipe diameter, D, the density, ρ, and the roughness height, ε. Determine a set of dimensionless groups that can be used in the correlation of data.

6 (18%) When a uniform stream flows past an immersed thick cylinder, a broad low-velocity wake is created downstream, idealized as a V shape in Fig.P6. Pressures P_1 and P_2 are approximately equal. If the flow is two-dimensional and incompressible, with width b into the paper, derive a formula for the drag force F on the cylinder. Rewrite your results in the form of a dimensionless drag coefficient based on body length $C_D=F/(\rho U^2 bL)$

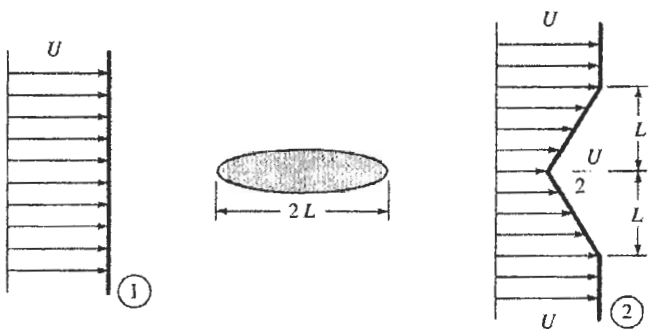


Fig. P6