淡江大學 97 學年度轉學生招生考試試題

頁

系別:航空太空工程學系三年級 科目:流 體 力 學

P	否使用	月計算4	幾	
可		否		
太試題	# <i>5</i>	大題	,	/

1. Explain the physical meanings and relationships of the following:

(20%)

- (a) Vorticity and Circulation
- (b) Turbulent Flow and Laminar Flow
- (c) Lagrangian and Eulerian Approaches of Fluid Motion
- (d) Velocity Potential and Stream Function
- (e) Inviscid Flow and Viscous Flow
- 2. The mass conservation equation has the form $\frac{\partial \rho}{\partial t} + \nabla \cdot (\rho \vec{\nu}) = 0$. Do we need to assume the flow is "steady" in order to derive the incompressible flow continuity equation? Please discuss and derive it. (20%)
- 3. Please explain the definition and physical meaning of flow streamline in details. Why these streamlines can be treated as "solid boundaries"? Can we simply just assume the "no-slip" boundary condition on these streamlines? Explain why. (20%)
- 4. At low Reynolds number, the volume flow rate Q through a small tube is only a function of the tube radius R, the fluid viscosity μ , and the pressure drop per unit tube length dP/dx. Now derive this function Q=f(R, μ , dP/dx) through the dimensional analysis. (Hint: $\rho \frac{\partial \overline{V}}{\partial t} + \rho \overline{V} \cdot \nabla \overline{V} = -\nabla P + \mu \nabla^2 \overline{V}$ is Navier-Stokes equation) (20%)
- Air flow steadily between two sections in a long, straight portion of 4-inch inner diameter pipe as shown in the diagram. The uniformly distributed temperature and pressure at each section are given. If the average air velocity (non-uniform distribution) at section (2) is 1000ft/s, please calculate the average air velocity at section (1).

