

國立成功大學

111學年度碩士班招生考試試題

編 號： 107

系 所： 水利及海洋工程學系

科 目： 流體力學

日 期： 0220

節 次： 第 1 節

備 註： 可使用計算機

※ 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. The pressure far from an irrotational vortex (a simplified tornado) in the atmosphere is zero gage. If the velocity at $r = 20$ m is 20 m/s, estimate the velocity and the pressure at $r = 2$ m. (Note: the irrotational vortex ceases to be a good model for a tornado when r is small. In the “eye” of the tornado the motion is approximated by rigid-body motion. The standard air density is $\rho_{air} = 1.2 \text{ kg/m}^3$) (25 %)
2. Determine the terminal velocity and corresponding Reynolds number of a smooth sphere if it is dropped in (a) air at 20°C and (b) water at 20°C . (Note: diameter of the sphere is $D = 30$ cm and its specific gravity is $S = 1.02$; specific weight of water $\gamma_w = 9800 \text{ N/m}^3$; density of water is $\rho_{water} = 1000 \text{ kg/m}^3$; $C_D = 0.2$ for air; $C_D = 0.5$ for water; kinematic viscosity of air $\nu_{air} = 1.6 \times 10^{-5} \text{ m}^2/\text{s}$; kinematic viscosity of water $\nu_{water} = 10^{-6} \text{ m}^2/\text{s}$) (25 %)
3. A scalar potential function is given by $\phi = A \cdot \tan^{-1}(y/x)$. Find the stream function $\psi(x, y)$. (20 %)
4. Derive an expression for the velocity distribution between horizontal, concentric pipes for a steady, incompressible developed flow. (30 %)

