國立中興大學 104 學年度碩士班招生考試試題

科目：流體力學　　系所：土木工程學系乙組

本科目可以使用計算機　　本科目試題共 1 頁

1. Fluids are still (see Fig. P1). Calculate the force on the wall (magnitude and direction) in *N/m*. $\rho_{water} = 1000\ kg/m^3$ and the specific gravity of oil is 0.8. ($g = 9.81\ m/s^2$) (25%)

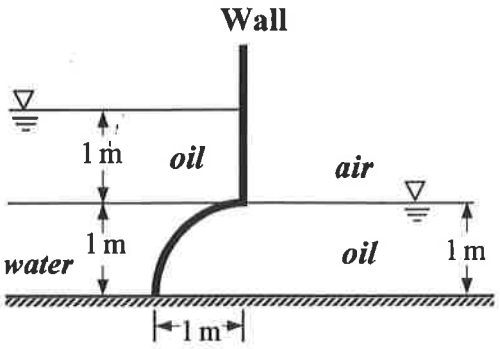

Fig. P1

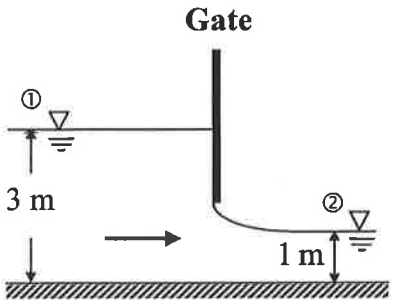

Fig. P2

2. In a two-dimensional steady gate flow of water as shown in Fig. P2 ($\rho_{water} = 1000\ kg/m^3$), sections ① and ② are far away from the gate. Friction is neglected. (25%)

   (a) Evaluate the force on the gate (magnitude and direction) in *N/m*. (20%)

   (b) Prove that hydraulic jump will occur downstream of section ②. (5%)

3. A velocity field is given by $\vec{V} = x\vec{i} + x(x-1)(y+1)\vec{j}$, where u and v are in m/s and x and y are in meters. Plot the streamline that passes through the origin $x = 0$ and $y = 0$. Compare this streamline with the pathline through the origin. (20%)

4. The drag, D_f, on a sphere located in a pipe through which a fluid is flowing is to be determined experimentally (see Fig. P4). Assume that the drag is a function of the sphere diameter, d, the pipe diameter, D, the fluid velocity, V, and the fluid density, ρ. (20%)

   (a) Determine a suitable set of dimensionless parameters for this problem using Pi theorem. (10%)

   (b) Some experiments using water indicate that for $d = 0.5$ cm, $D = 1.3$ cm, and $V = 0.6$ m/s, the drag is 6.7×10^{-3} N. Estimate the drag on a sphere located in a 0.6 m diameter pipe through which water is flowing with a velocity of 1.8 m/s. The sphere diameter is such that geometric similarity is maintained. (10%)

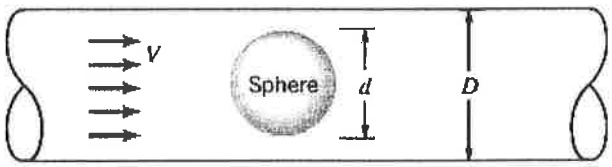

Fig. P4

5. What is the Reynolds stress? (10%)