國立嘉義大學99學年度
土木與水資源工程學系碩士班（乙組）招生考試試題

科目：流體力學

說明：1.如有條件不足之情形，請自行假設。2.僅可使用試務單位提供之計算機。

1. (a) Please derive the differential form of continuity equation (5%)

   (b) What is the incompressible fluid? (write an equation to explain the definition of incompressible fluid). Please write the differential form of continuity equation for the incompressible fluid. (5%)

   (c) If the velocity filed is $\vec{V}(x,y,z) = 4xy\vec{i} + 2(x^2 - y^2)\vec{j} + 0\vec{k}$, determine the volumetric dilatation rate. Is the fluid in the flow filed compressible or incompressible? (10%)

2. A mountain lake has an average temperature of 10 °C and a maximum depth of 45 m. For a barometric pressure of 598 mm Hg, determine the absolute pressure (in pascals) at the deepest part of the lake. (the unit weight of water at 10°C is 9.804 kN/m^3) (20%)

3. A certain spillway for a dam is 20 m wide and is designed to carry 125 m^3/s at flood stage. A 1:15 model is constructed to study the flow characteristics through the spillway. Determine the required model width and flowrate. The effects of surface tension and viscosity are to be neglected. (20%)

4. As shown in Fig.1, at the entrance to 3-ft-wide channel the velocity distribution is uniform with velocity V. Further downstream the velocity profile is given by u = 4y-2y^2, where u is in ft/s and y is in ft. Determine the value of V. (20%)

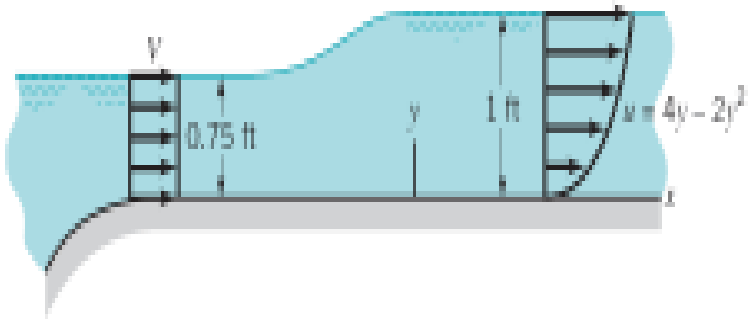

Fig.1

5. A free jet of fluid strikes a wedge as shown in Fig. 2, Of the total flow, a portion is deflected 30°; the remainder is not deflected. The horizontal and vertical components of force needed to hold the wedge stationary are F_H and F_V, respectively. Gravity is negligible, and the fluid speed remains constant. Determine the force ratio, F_H/F_V. (20%)

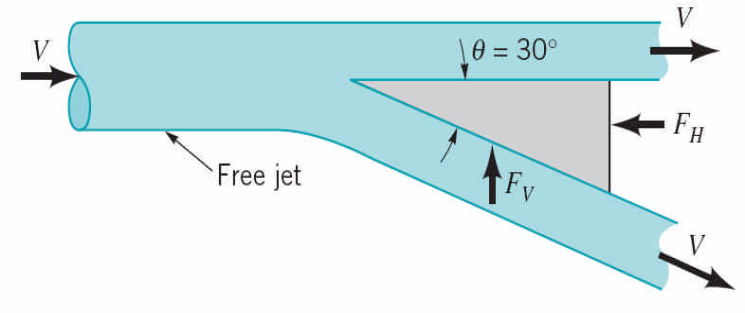

Fig.2