編號： 142

國立成功大學 109 學年度碩士班招生考試試題

系　　所：環境工程學系

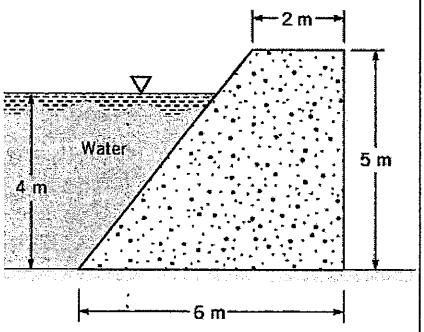
考試科目：流體力學

考試日期：0210，節次：2

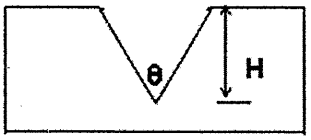
※ 考生請注意：本試題不可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. Flow characteristics for a 9 m diameter prototype parachute are to be determined by tests of a 0.3 m diameter model parachute in a water tunnel. Some data collected with the model parachute indicate a **drag** of 50 N when the water velocity is 1 m/s. Use the model data to predict the drag on the prototype parachute falling through air at 3 m/s. Assume the drag to be a function of the velocity, **V**, the fluid density, **ρ** and the parachute diameter, **D**. (the densities of water and air are 1000 and 1.225 kg/m^3, respectively) (20%)

2. The concrete dam weights 23.6 kN/m^3 and rests on a solid foundation. Determine the minimum coefficient of friction between the dam and the foundation required to keep the dam from sliding at the water depth shown. Assume no fluid uplift pressure along the base. Base your analysis on a unit length of the dam (20%)



3. A V-notch weir is shown in following Figure. The discharge coefficient is C_N. θ is the angle of V-notch weir. Please derive the **volume flowrate ($\dot{V}$)** as a function of H (20%)



4. Fresh water (ρ_{water} = 1000 kg/m^3) flows into an open 55 m^3 drum initially filled with seawater ($\rho_{seawater}$ = 1023 kg/m^3). The fresh water mixes thoroughly with the seawater, and the mixture overflows out of the drum. If the fresh water flowrates is 10 m^3/min, estimated the time in seconds required to decrease the difference between the density of the mixture and the density of fresh water by 50%. (20%)

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5. Two water reservoirs of height h_1 =60 m and h_2 =30 m are connected by a pipe that is 0.35 m in diameter. The exit of the pipe is submerged at distance h_3 =8 m from the reservoir surface. Kc and Ke are entrance loss coefficients. The kinematic viscosity of water is 9.95×10^{-7} m^2/s.

(a) Determine the flow rate through the pipe if the pipe is 80 m long and the friction factor f = 0.004 (10%)

(b) If the relative roughness is e/D =0.004, please calculate the flow rate (10%)