國立成功大學

112學年度碩士班招生考試試題

編　號：144

系　所：環境工程學系

科　目：流體力學

日　期：0206

節　次：第 2 節

備　註：不可使用計算機

編號： 144

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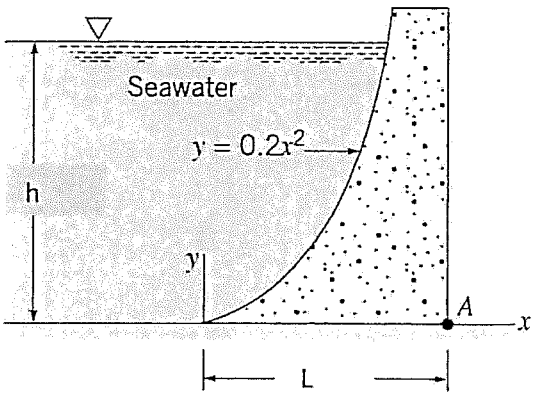
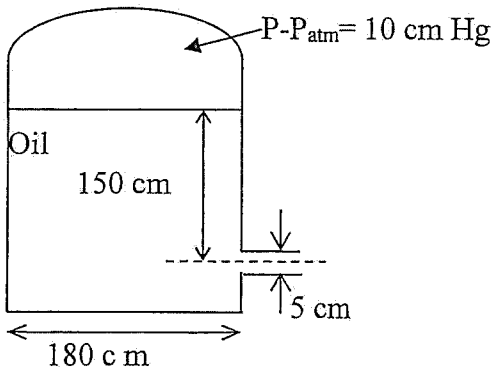
※ 考生請注意：本試題不可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

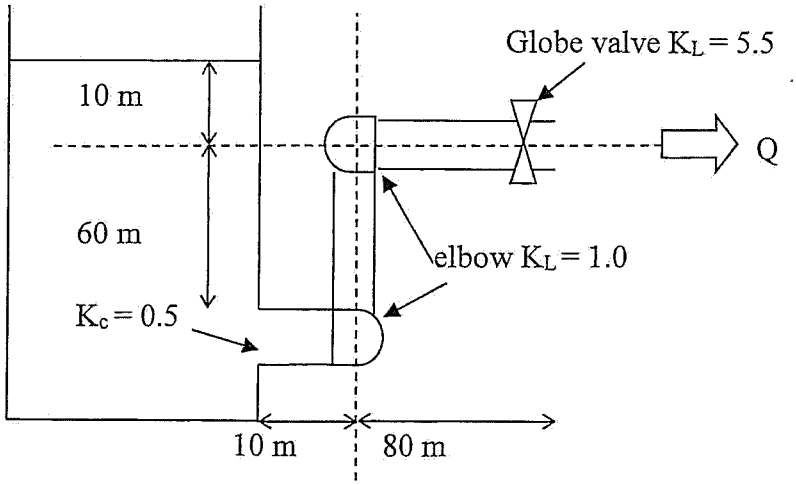
1. The concrete seawall (see below) has a curved surface and restrains seawater (specific weight = γ kg/m^3) at a depth of h m. The trace of the surface is a parabola as illustrated. Please describe how to determine the moment of the fluid force (per unit length) with respect to an axis through the toe (point A). (20%)



2. The pressurized tank shown has a circular section of 180 cm in diameter. Oil is drained through a nozzle 5 cm in diameter in the side of the tank. Assuming that the air pressure is maintained constant, how long does it take to lower the oil surface in the tank by 60 cm? The specific gravity of the oil in the tank is 0.85 and that of the mercury is 13.6. (20%)



3. A pie flow system can be seen below. The friction factor (f) and diameter of pipe is 1×10^{-3} and 15 cm, respectively. The loss coefficients of sudden contraction, elbow and global valve are shown in the following figure. Please calculate the flow rate Q (m^3/s). (20%)



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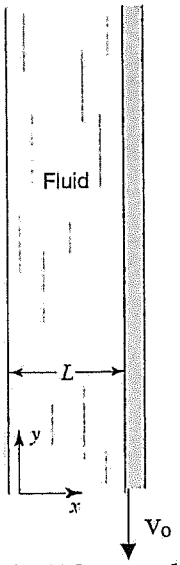
4. Navier-Stokes equation can be shown below.

(a) Please describe physical meaning of each term in the equation. (10%)

$$\rho\frac{D\mathbf{v}}{Dt} = \rho\mathbf{g} - \nabla P + \mu\nabla^2\mathbf{v}$$

(b) As shown in the right figure, an incompressible fluid confined between two parallel, vertical surfaces. The left surface is stationary, whereas the other is moving downward at a constant velocity (v_o). If we consider the fluid Newtonian and the flow laminar, the governing equation of motion is the Navier-Stokes equation. Please illustrate the velocity profile. (10%)



5. Water at 15.6 °C ($\nu = 1.12 \times 10^{-6}$ m^2/s) is to flow from reservoir B through a pipe of length 518 m and roughness 0.00015 m at a rate of Q = 0.74 m^3/s as shown. The system contains a sharp-edged entrance and four flanged 45° elbows. The loss coefficients of sudden contraction, expansion and elbows are shown in the following figure. Please describe how to use the Moody chart (below) to determine the pipe diameter needed. (20%)