

國立中山大學 102 學年度碩士暨碩士專班招生考試試題

科目名稱：流體力學【海工系碩士班甲組選考】

題號：459002

※本科目依簡章規定「可以」使用計算機（廠牌、功能不拘）

共 2 頁 第 1 頁

1. Explain the following terms: (10%)
 (1) No-slip condition (2) Irrotational flow (3) Energy grade line (4) Hydraulic jump (5) Pressure center
2. A 0.45 kg, 0.24 m-diameter, 0.3 m-tall cylindrical tank slides slowly down a ramp with a constant speed of 0.03 m/s as shown in Fig. 1. The uniform-thickness oil layer on the ramp has a viscosity of 0.01 Ns/m^2 . Determine the angle, θ , of the ramp. (15%)

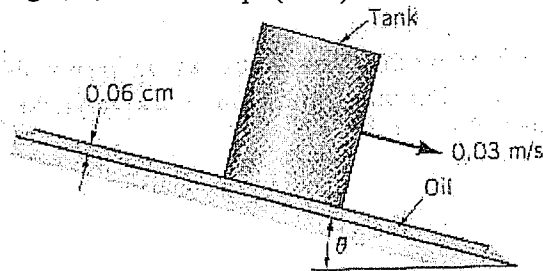


Fig. 1

3. A rectangular gate having a width of 1.2 m is located in the sloping side of a tank as shown in Fig. 2. The gate is hinged along its top edge and is held in position by the force P . Friction at the hinge and the weight of the gate can be neglected. Determine the required value of P . (15%)

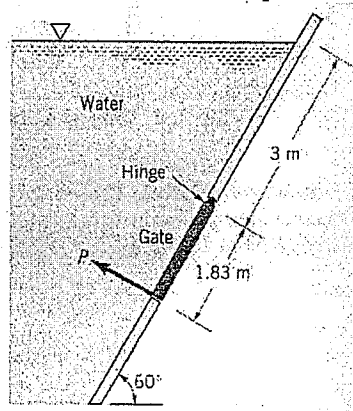


Fig. 2

4. A thin 1.2 m wide, right-angle gate with negligible mass is free to pivot about a frictionless hinge at point O , as shown in Fig. 3. The horizontal portion of gate covers a 0.3 m diameter drain pipe, which contains air at atmospheric pressure. Determine the minimum water depth, h , at which the gate will pivot to allow water to flow into the pipe. (15%)

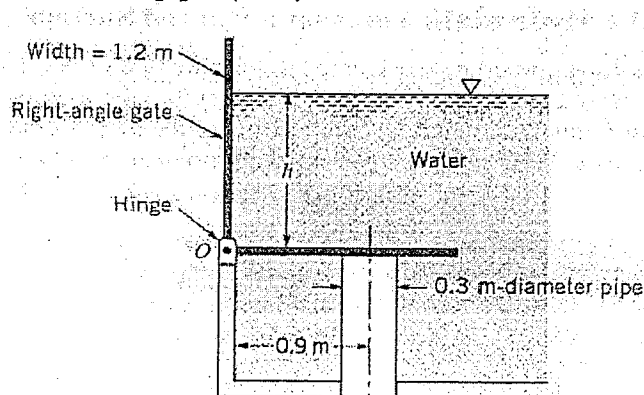


Fig. 3

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5. A long water trough of triangular cross section is formed from two planks as is shown in Fig. 4. A gap of 0.25 cm remains at the junction of the two planks. If the water depth initially was 0.6 m, how long a time does it take for the water depth to reduce to 0.3m? (15%)

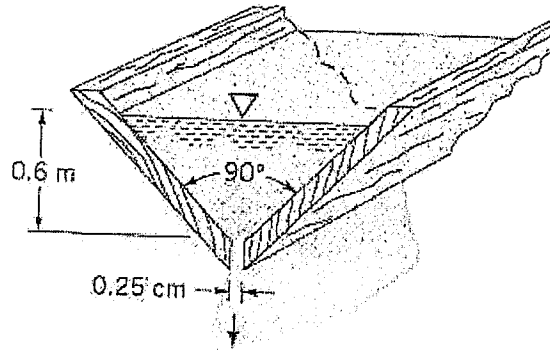


Fig. 4

6. Find a relationship between the acceleration of the cylinder cart and the variables shown in Fig. 5, neglect friction. The initial mass of the cart and water is M_0 . (15%)

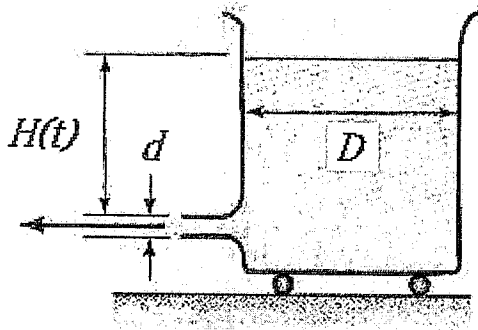


Fig. 5

7. Find the acceleration vector field where x, y, z are in meters. Evaluate the acceleration at $(2, -1, 3)$ at $t = 2s$. (15%)

(a) $V = 2x\hat{i} - 2y\hat{j}$ m/s

(b) $V = x^2t\hat{i} + 2xyt\hat{j} + 2yzt\hat{k}$ m/s

(c) $V = x\hat{i} - 2xyz\hat{j} + tz\hat{k}$ m/s