



UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
(ONLINE)
SEMESTER I
SESSION 2020/2021**

COURSE NAME : FLUID MECHANICS 1
COURSE CODE : BDA 20603
PROGRAMME : BDD
EXAMINATION DATE : JANUARY/FEBRUARY 2021
DURATION : 3 HOURS
INSTRUCTION : **PART A:**
ANSWER **FOUR (4)** QUESTIONS
ONLY OUT OF FIVE (5)
QUESTIONS
PART B:
ANSWER **ALL** QUESTIONS

THIS QUESTION PAPER CONSISTS OF FIVE (5) PAGES

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PART A: ANSWER FOUR (4) QUESTIONS ONLY OUT OF FIVE (5) QUESTIONS

- Q1** (a) Surface tension forces can be strong enough to allow a steel razor blade to barely “float” on water. The total length of its sides is 200 mm. The temperature of the water is 20°C. Determine the mass of the blade weight. (5 marks)
- (b) A 12 cm-diameter circular plate is placed over a fixed bottom plate with a 0.5 mm-gap between the two plates filled with an unknown liquid as shown in **Figure Q1 (b)**. Develop an equation relating the torque, the angular speed, the viscosity and the radius of the plate. Determine the viscosity of the liquid when the torque required to rotate the circular plate slowly at 2000 rpm is 0.1 Nm. Assume that the velocity distribution in the gap is linear and that the shear stress on the edge of the rotating plate is negligible. (15 marks)
- Q2** (a) Determine the elevation difference, Δh , between the water levels in the two open tanks shown in **Figure Q2 (a)**. The specific gravity of the gage fluid is 0.9 and ℓ is 0.4 m. (7 marks)
- (b) The rigid gate, OAB, of **Figure Q2 (b)** is hinged at O and rests against a rigid support at B. What minimum horizontal force, P, is required to hold the gate closed if its width is 3 m? Neglect the weight of the gate and friction in the hinge. The back of the gate is exposed to the atmosphere. (13 marks)
- Q3** The thin-walled, 1-m-diameter tank of **Figure Q3** is closed at one end and has a mass of 90 kg. The open end of the tank is lowered into the water and held in the position at a depth of h by a solid block having a density of 7840 kg/m³. The tank height, ℓ , is 3 m. Assume that the air that is trapped in the tank is compressed at a constant temperature. Determine the weight of the solid block when h is 10 m. (20 marks)
- Q4** Water is siphoned from the tank shown in **Figure Q4**. The diameter of the hose used is 10 mm. The a , b , and c are 2 m, 3 m, and 8 m respectively. Determine the flow rate from the tank and the pressure at points (2), (3), and (4) if viscous effects are negligible. (20 marks)

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- Q5** A jet of water 50 mm in diameter with a velocity of 20 m/s strikes a flat plate inclined at an angle of 30° to the axis of the jet. Determine
- the normal force exerted on the plate when the plate is stationary;
 - the normal force exerted on the plate when the plate is moving at 5 m/s in the direction of the jet;
 - the work done on the plate and the efficiency for case (ii).
- (20 marks)

PART B: ANSWER ALL QUESTIONS

- Q6** The downforce of an F1 car's wing, F'_{dw} , is a function of wingspan, W , chord length, H , surrounding air density, ρ , and viscosity, μ , and velocity, V . Using ρ , V , and W as repeating variables, express this relationship in dimensionless form
- (20 marks)

- END OF QUESTIONS -

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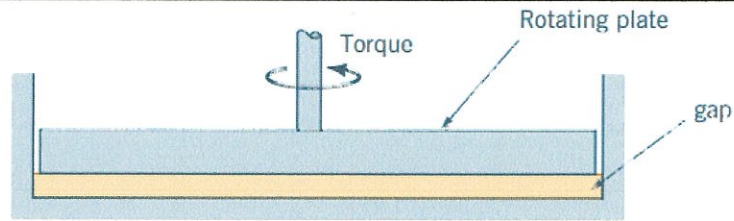


Figure Q1 (b)

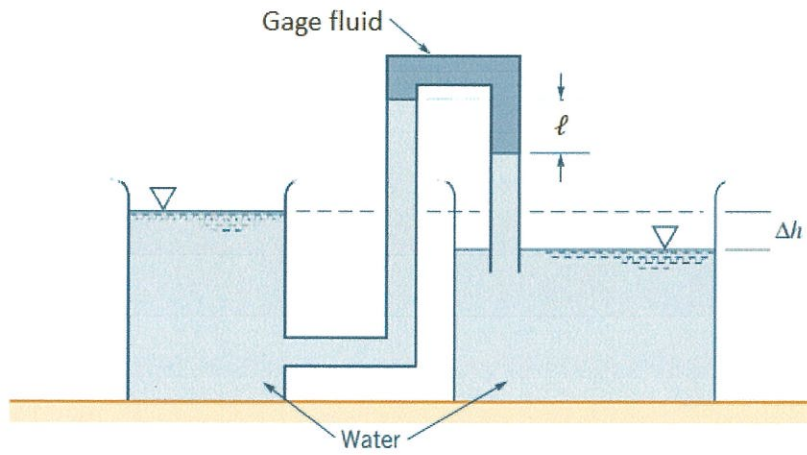


Figure Q2 (a)

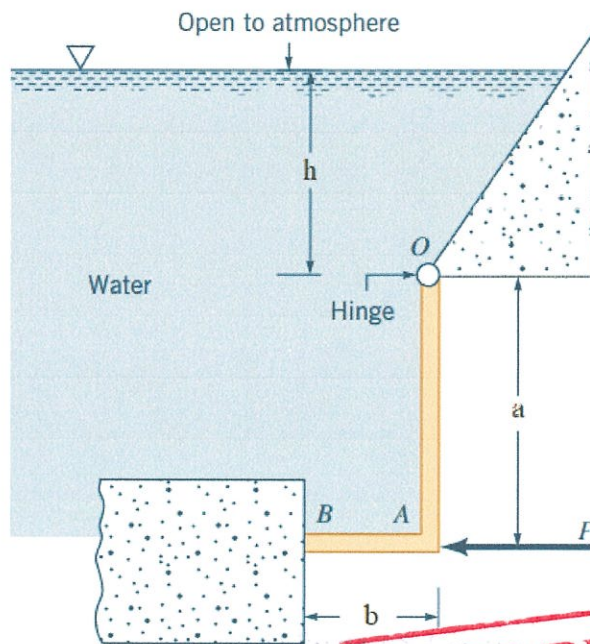


Figure Q2 (b)

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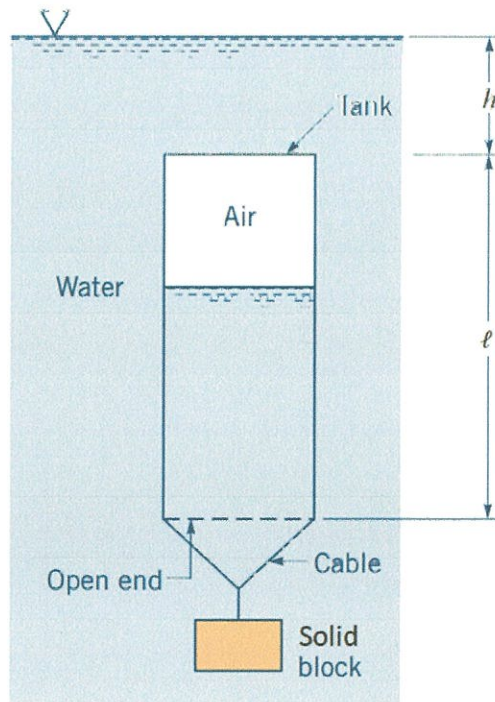


Figure Q3

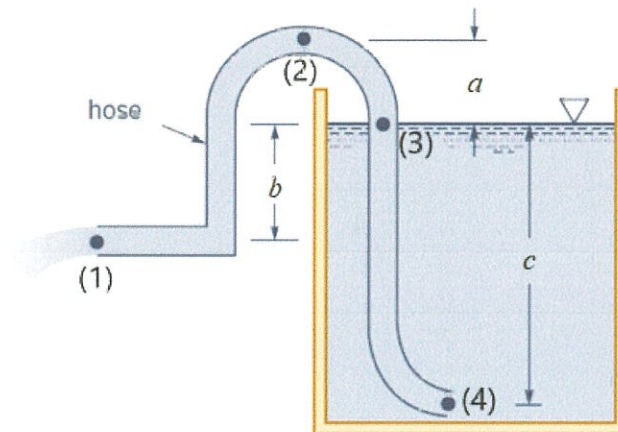


Figure Q4

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