UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
(ONLINE)
SEMESTER II
SESSION 2020/2021

COURSE NAME	:	FLUID MECHANICS 1
COURSE CODE	:	BDA 20603
PROGRAMME	:	BDD
EXAMINATION DATE	:	JULY 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 **SEVEN (7)** PAGES

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

Q1 (a) Prove that a solid aluminum cube, such as shown in **Figure Q1 (a),** can float on water at 20 °C due to the effect of surface tension? The density of the aluminum cube is 2700 kg/m^3. Prove that a solid steel cube with a density of 7800 kg/m3 can float too.

(13 marks)

(b) A 10-kg block is pulled up on a smooth inclined surface by force F as shown in **Figure Q1 (b)**. Determine the velocity of the block if the 0.1-mm gap between the block, the force F is 80 N, and the surface contains SAE 30 oil at 20 °C. The area of the block in contact with the oil is 0.1 m^2.

(7 marks)

Q2 (a) The system that is shown in **Figure Q2 (a)** is used to measure the pressure changes ΔP in the water pipe. When $\Delta h = 7$ mm, what is the change in the pipe pressure?

(4 marks)

(b) The maximum force that holds the 4-m-width gate in **Figure Q2 (b)** close is 50 kN. If oil is being added steadily, determine the maximum h before the gate starts to open. $SG_{oil} = 0.86$.

(16 marks)

Q3 (a) The U-tube shown in **Figure Q3 (a)** is rotated about one of its arms at an angular speed of ω rad/s. At ω = 0 rad/s, the U-tube contains 20-cm-high alcohol in both arms Determine the new ω when the elevation difference between the fluid surfaces in the two arms is 30 cm.

(8 marks)

(b) A cone is placed in a water tank as shown in **Figure Q3 (b)**. If the mass of the cone is 1.1 kg, and the tension in the cord connecting to the bottom of the tank is 24 N, determine the height of the cone that is below the water surface?

(12 marks)

Q4 (a) The speed of an aircraft flying at an altitude of 11 km is measured by a pitot-static probe. If the differential pressure reading is 12.9 kPa, determine the speed of the aircraft in km/h. Take the density of air to be 0.4135 kg/m^3.

(5 marks)

(b) The water is siphoned out of the tank shown in **Figure Q4 (b)**. Determine the flow rate from the tank and the pressures at points (1) and (2).

(15 marks)

Q5 (a) A 90° elbow shown in **Figure Q5 (a)** is to direct water flow upward at a rate of 50 kg/s. The water is flowing from a horizontal pipe at the elbow's inlet. The inner diameter of the entire elbow is 10 cm. The elbow discharges water into the atmosphere. The elevation difference between the centers of the exit and the inlet of the elbow is 40 cm. Determine the horizontal anchoring force needed to hold the elbow in place.

(12 marks)

(b) A 9-cm-diameter horizontal water jet strikes a curved plate, which deflects the water 180° at the same speed. Determine the water jet speed as the force required to hold the plate against the water stream is 7 kN.

(8 marks)

PART B: ANSWER ALL QUESTIONS

Q6 The lift of a wing, F_{lift}, 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 (a)

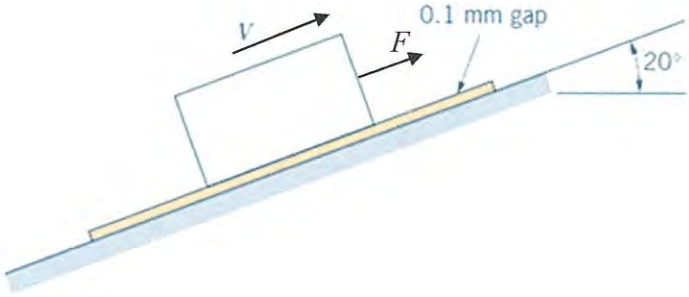

Figure Q1 (b)

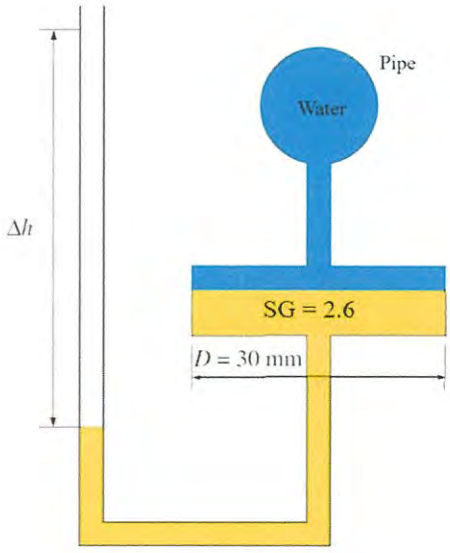

Figure Q2 (a)

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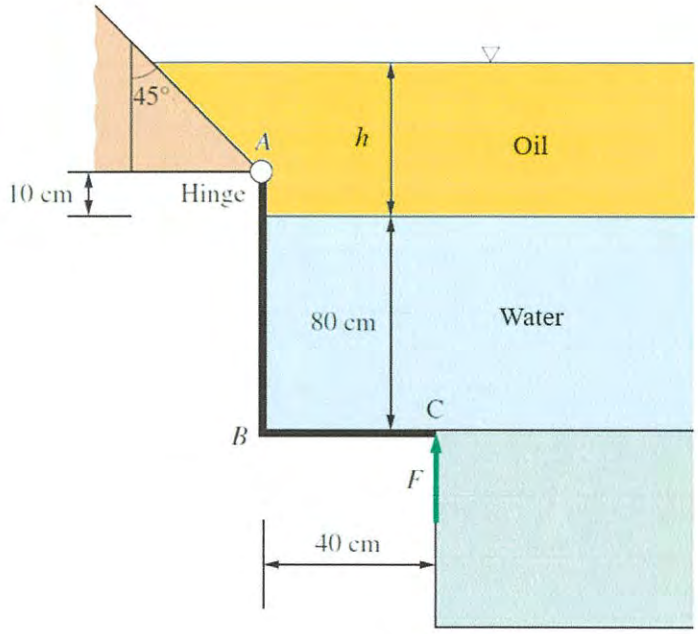

Figure Q2 (b)

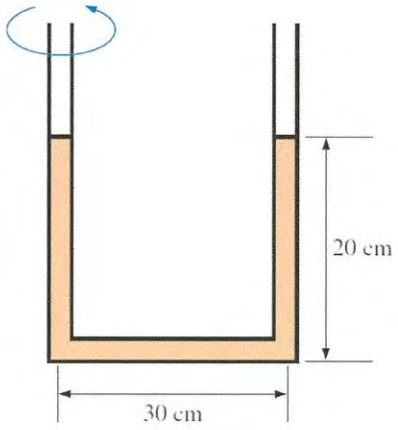

Figure Q3 (a)

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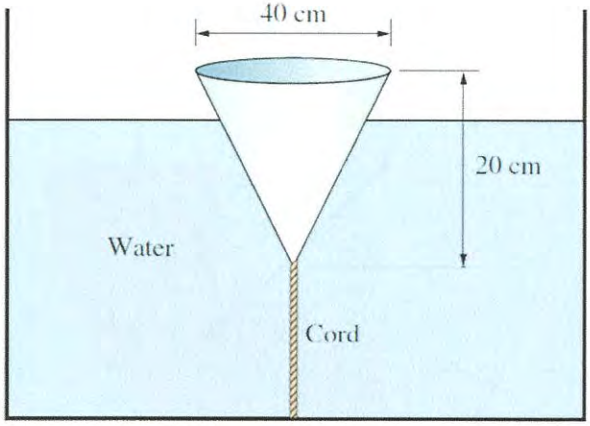

Figure Q3 (b)

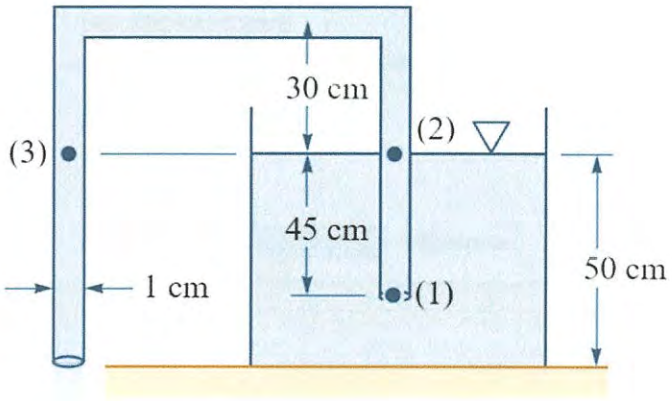

Figure Q4 (b)