Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2019/2020

COURSE NAME	:	FLUID MECHANICS
COURSE CODE	:	DAM 31503/DAJ21603
PROGRAMME CODE	:	DAM/DAJ
EXAMINATION DATE	:	DECEMBER 2019/JANUARY 2020
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWERS **FIVE (5)** QUESTIONS ONLY

THIS QUESTION PAPER CONSISTS OF **SEVEN (7)** PAGES

Q1 (a) Give **three (3)** advantages and **three (3)** disadvantages of a manometer.

(6 marks)

(b) A hydraulic cylinder must be able to exert a force of 38.8 kN. The piston diameter is 40 mm. Compute the required pressure in the oil.

(6 marks)

(c) A tank used to store a gasoline and gliserine as shown in **Figure Q1 (c)**. If the gauge pressure A give a reading of 1.5 kPa, determine the height of fluid in piezometer tube B and C measure from bottom of the tank.

(8 marks)

Q2 (a) Using appropriate sketches, explain briefly the following terms;

(i) center of pressure
(ii) center of gravity
(iii) pressure prism

(6 marks)

(b) A 1 m-diameter cylindrical mass, M, is connected to a 2 m-wide rectangular gate as shown in **Figure Q2 (b)**. The gate is to open when the water level, h, drops below 2.5 m. Determine the required value for M. Neglect friction at the gate hinge and the pulley.

(14 marks)

Q3 (a) The expression below calculates the discharge in a pipeline from measurement of the pressure at the tapping points of a Venturimeter.

$$Q_{actual} = C_d A_1 A_2 \sqrt{\frac{2g\left[\frac{p_1 - p_2}{\rho g} + z_1 - z_2\right]}{A_1^2 - A_2^2}}$$

Show that if the pressure is measured using a manometer, as depicted in **Figure Q3 (a)**, then the inclination of the meter is not relevant.

(12 marks)

(b) A Venturimeter with a throat diameter of 40 mm is connect to a 100 mm pipeline. When the flow in the pipeline is 12 litre/s the difference in pressure on a mercury manometer is 375 mm. Determine the coefficient of discharge at this flow. (The spesific gravity of mercury is 13.6).

(8 marks)

Q4 (a) Give an example of body forces and surface forces acting on a control volume with an aided of appropriate sketch.

(3 marks)

(b) Water flows steadily through the elbow shows in **Figure Q4 (b)** at a rate of 0.13 m^3/s and exits to the atmosphere. The pipe diameter d_1 = 30 cm while outlet diameter d_2 = 10 cm. If the internal volume of the elbow is 0.03 m^3 and the weight of the elbow is 5 kg, determine the magnitude of force acting on the flange of the elbow.

(17 marks)

Q5 (a) Describe **five (5)** factors contributing to the major losses in pipes.

(5 marks)

(b) A pump is use to deliver water at 0.025 m^3/s from one reservoir to another at 8 m higher. The piping system consists of 20 m of wrought iron pipe with the diameter of 4 cm, a reentrant entrance (K_L = 1.0), two screwed 90° long-radius elbows (K_L = 0.4 each), a screwed-open gate valve (K_L = 0.16) and a 6° well-designed conical expansion (K_L = 0.3) at the exit. By taking the density of water, ρ = 1000 kg/m^3 and viscosity of water, μ = 0.001 kg/m.s, calculate the pump power required.

(15 marks)

Q6 (a) Explain **two (2)** from three types of similarity.

(4 marks)

(b) The pressure rise Δp across a pump is a function of the impeller diameter D, the fluid density ρ, the rotational speed ω, and the flowrate Q. Using D, ρ and Q as repeating variables, determine a suitable set of dimensionless parameters.

(10 marks)

(c) A large valve having a 609.6 mm diameter inlet is to be build. This prototype will carrying water at a flowrate of 0.8495 m^3/s. A several experimental tests are to be performed on the valve model with the inlet diameter of 76.2 mm. If the working fluid in the model is water at the same temperature as that in the prototype, and complete geometric similarity exists between model and prototype, determine the required flowrate in the model test.

(6 marks)

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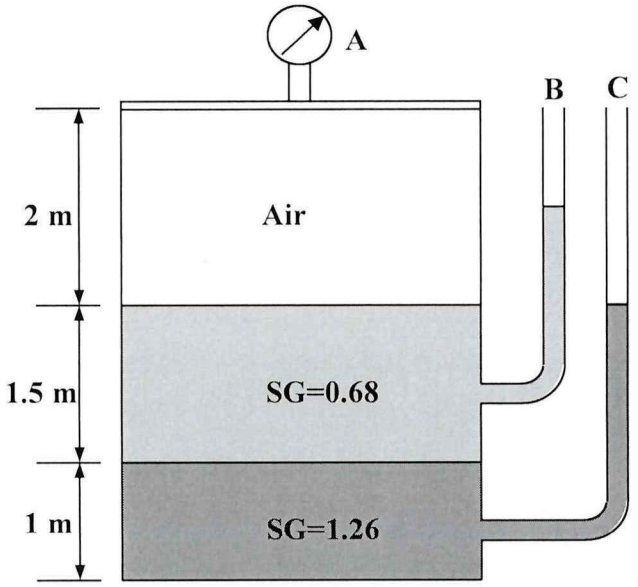

Figure Q1 (c)

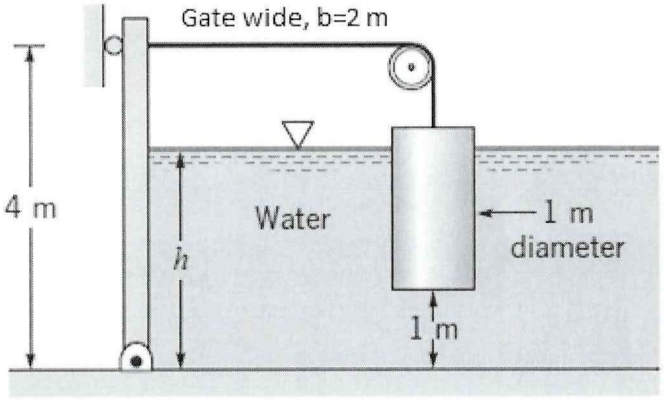

Figure Q2 (b)

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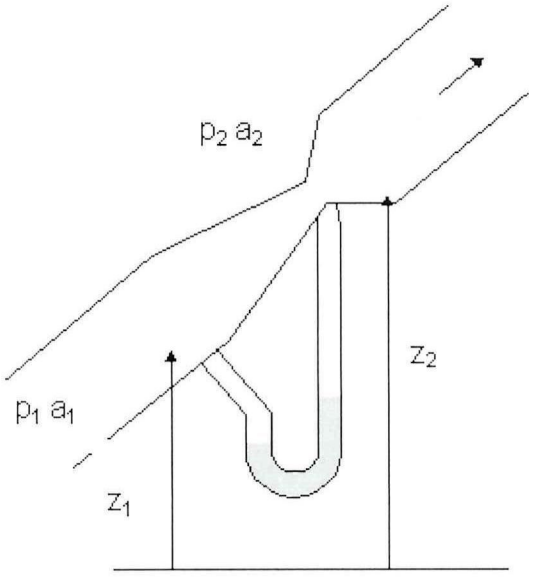

Figure Q3 (a)

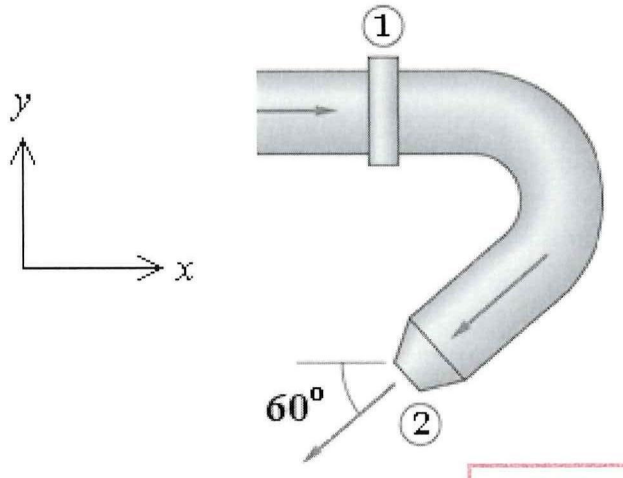

Figure Q4 (b)

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