Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2018/2019

COURSE NAME	:	FLUID MECHANICS 1
COURSE CODE	:	BDA 20603
PROGRAMME	:	BDD
EXAMINATION DATE	:	JUNE / JULY 2019
DURATION	:	3 HOURS
INSTRUCTION	:	**PART A:** ANSWER **THREE (3)** QUESTIONS ONLY OUT OF **FOUR (4)** QUESTIONS **PART B:** ANSWER **ALL** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **SIX (6) PAGES**

PART A: ANSWER THREE (3) QUESTIONS ONLY OUT OF FOUR (4) QUESTIONS

Q1 (a) The cylindrical tank with hemisperical end shown in **Figure Q1 (a)** contains a volatile vapor density and its vapor. The liquid density is 800 kg/m^3, and its vepor density is neglibible. The pressure in the vapor is 120 kPa (abs) and the atmospheric pressure is 101 kPa (abs). Determine:

(i) the gage pressure reading on the pressure gauge.
(ii) The height, *h*, of the mercury manometer.

(12 marks)

(b) A triangular gate shown in **Figure Q2 (b)** has an angle of 65° from the bottom of a water tank. Sketch the free-body diagrams and determine the resulting force (F_R) acting on the gate and its line of action (y_R).

(8 marks)

Q2 (a) Determine the specific gravity of an iceberg that floats in the ocean (specific gravity 1.025) as 89 % of its volume is under water.

(6 marks)

(b) A cube (0.58 m x 0.58 m x 0.58 m) made of metal with density of 9200 kg/m^3 is placed in sea water with density of 1025 kg/m^3.

(i) Draw a free body diagram that indicates all the forces acting on the floating metal cube;
(ii) Determine the magnitude and direction of the external force required to enable the metal cube to float with 50% of its body is under water.

(14 marks)

Q3 (a) Streams of water from two tanks impinge upon each other as shown in **Figure Q3 (a)**. If viscous effects are negligible and point *A* is a stagnation point, determine the height *h*.

(8 marks)

(b) Determine the density, ρ_m, of the liquid inside the U tube providing that the flowrate through the pipe in **Figure Q3 (b)** is 0.012 m^3/s.

(12 marks)

Q4 (a) Describe body forces and surface forces acting on a control volume. Give two (2) examples for each force.

(6 marks)

(b) A 12 cm diameter pipe, containing water flowing at 20.4 kg/s, is capped by an orifice plate as shown in **Figure Q4 (b)**. The exit jet is 25 mm in diameter. The pressure in the pipe at section 1 is 800 kPa. Calculate the force required to hold the orifice plate.

(14 marks)

PART B: ANSWER ALL QUESTIONS ONLY

Q5 (a) With the aid of sketches, state four (4) conditions which contributed to the minor losses

(4 marks)

(b) A water tank filled with solar-heated water at 40°C is to be used for showers in a field using gravity driven flow. The system includes 35 m of 1.3-cm-diameter galvanized iron piping with four miter bends (90°) without vanes and wide-open globe valve as shown in **Figure Q6 (b)**. If water is to flow at a rate of 1.2 L/s through the water head, determine how high the water level in the tank must be from the exit level of the shower. The density and dynamic viscosity of water at 40°C are $\rho = 992.1$ kg/m^3 and $\mu = 0.653\times10^{-3}$ kg/m·s, respectively. The loss coefficient for 4 miter bends (90°) without vanes ($K_L = 1.1$ each), and a wide open globe valve ($K_L = 10$). The losses at the entrance and at the showerhead are said to be negligible. The roughness of galvanized iron pipe is $\varepsilon = 0.00015$ m.

(16 marks)

Q6 (a) The flow rate (Q) through an orifice plate is a function of pipe diameter (D), pressure drop (Δp) across the orifice, fluid density (ρ), viscosity (μ), and orifice diameter (d). Using D, ρ and Δp as repeating variables, express this relationship in dimensionless form?

(15 marks)

(b) The aerodynamic drag of a new sports car is to be predicted at a speed of 80 km/hr at air temperature of 25°C. Automotive engineers build a one fifth scale model of the car to test in a wind tunnel. It is winter and the wind tunnel is located in an unheated building; the temperature of the wind tunnel air is only about 5°C. Determine how fast the engineers should run the wind tunnel in order to achieve similarity between the model and the prototype. The density of air at 5° and 25° are 1.269 kg/m^3 and 1.184 kg/m^3, respectively. The viscosity of air at 5° and 25° are 1.754 x 10^{-5} kg/m.s and 1.849 x 10^{-5} kg/m.s, respectively.

(5 marks)

- END OF QUESTIONS -

FINAL EXAMINATION

SEMESTER / SESSION : SEM II / 2018/2019 PROGRAMME : BDD
COURSE : FLUID MECHANICS 1 COURSE CODE : BDA20603

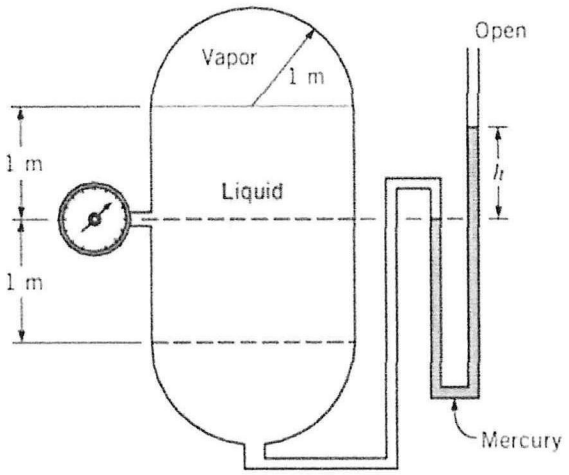

Figure Q1 (a)

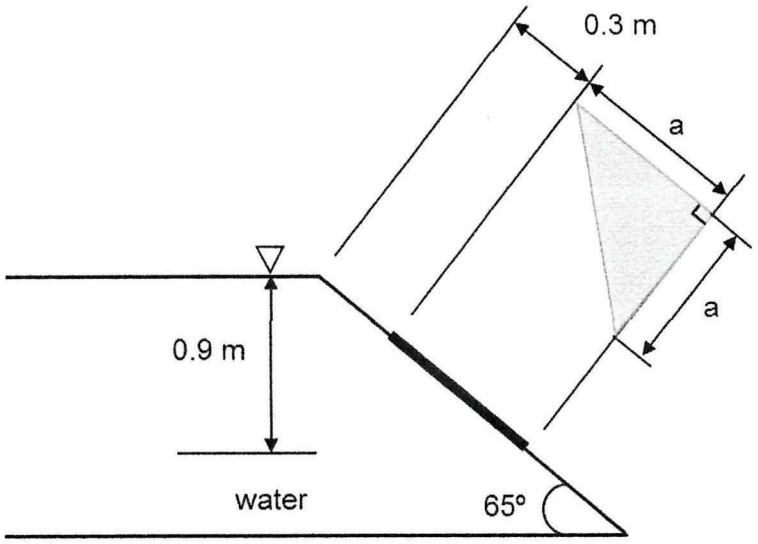

Figure Q1 (b)

FINAL EXAMINATION

SEMESTER / SESSION : SEM II / 2018/2019 PROGRAMME : BDD
COURSE : FLUID MECHANICS 1 COURSE CODE : BDA20603

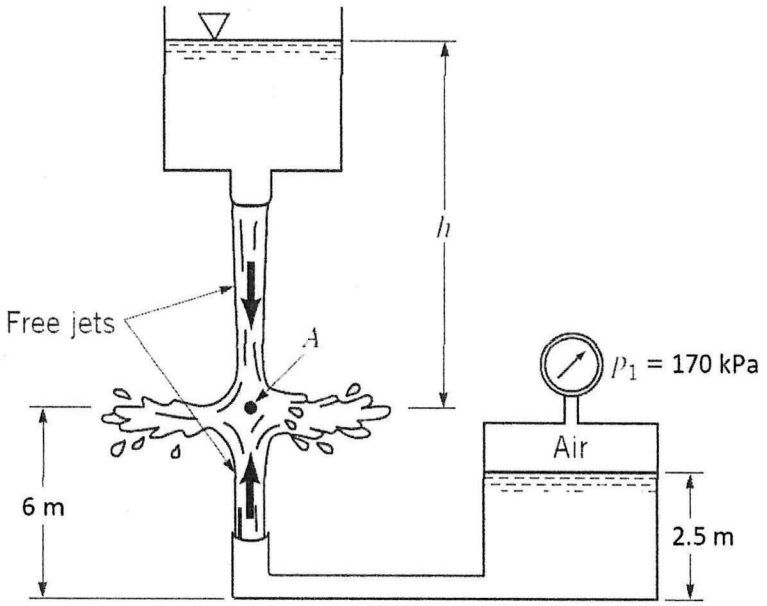

Figure Q3 (a)

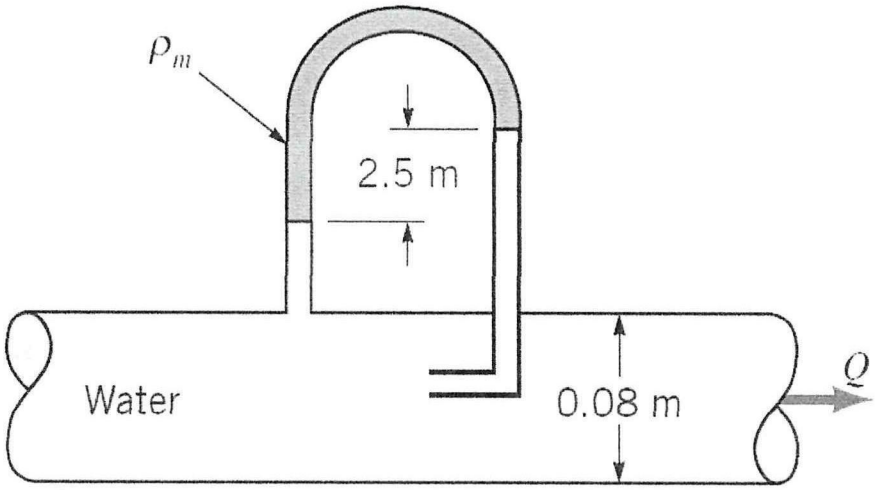

Figure Q3 (b)

FINAL EXAMINATION

SEMESTER / SESSION : SEM II / 2018/2019 PROGRAMME : BDD
COURSE : FLUID MECHANICS 1 COURSE CODE : BDA20603

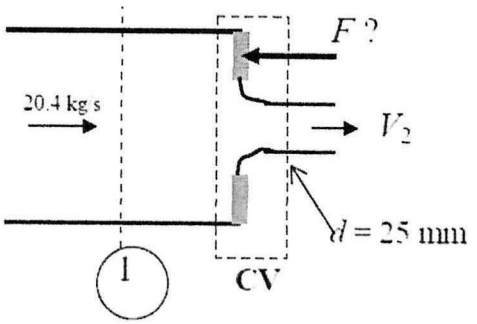

Figure Q4 (b)

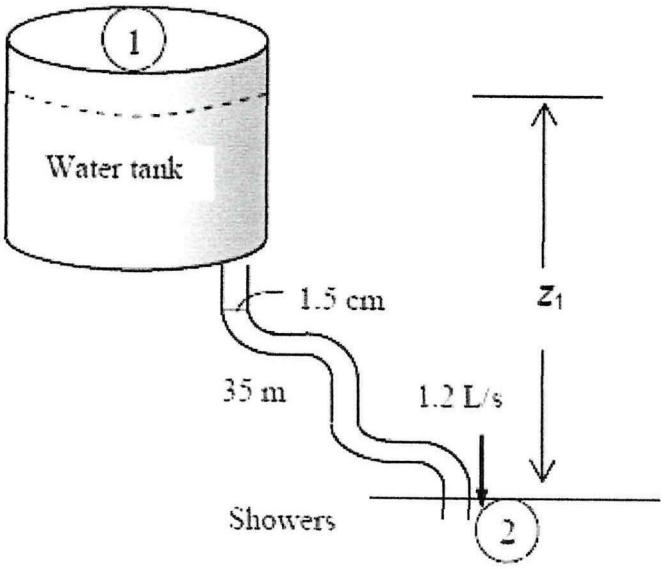

Figure Q6 (b)