UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2012/2013

COURSE NAME	:	FLUID MECHANICS 1
COURSE CODE	:	BDA 1052/ BDA10502
PROGRAMME	:	BDD
EXAMINATION DATE	:	JUNE 2013
DURATION	:	2 ½ HOURS
INSTRUCTION	:	ANSWER **FIVE (5)** QUESTIONS FROM **SIX (6)** QUESTIONS.

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

Q1 (a) (i) What is pressure measurement device used to measure the atmospheric pressure?

(ii) Using an appropriate illustration, explain how the working principle of the device you mentioned in (i).

(6 marks)

(b) A U-tube manometer is connected to a closed tank containing air and water as shown in **Figure Q1 (b)**. At the closed end of the manometer the air pressure is 110.3 kPa. Determine the reading on the pressure gauge.

(6 marks)

(c) A 152 mm diameter piston is located within a cylinder which is connected to a 13 mm diameter inclined tube manometer as shown in **Figure Q1(c)**. The fluid in the cylinder and the manometer is oil ($SG = 0.8$). When a weight W is placed on the top of the cylinder, the fluid level in the manometer tube rises from point (1) to (2). How heavy is the weight W?

(8 marks)

Q2 (a) Give the definition of the center of pressure.

(2 marks)

(b) Explain why dams are much thicker at the bottom.

(3 marks)

(c) A water gate with 2.4 m wide is hinged at point B as shown in **Figure Q2 (c).** If the weight of water gate is 21.5 kN, determine the weight of W in order to maintain the water level at 3.5 m.

(15 marks)

Q3 (a) Define bouyancy and bouyancy force.

(2 marks)

(b) Using an appropriate sketch, explain what means by Archimedes principle.

(4 marks)

(c) The hull of a boat has a volume of 150 m^3, and the total mass of the boat when empty is 8560 kg. Determine how much load in kN this boat can carry without sinking

(i) in a lake; and

(ii) in seawater with a specific gravity of 1.03.

(14 marks)

Q4 (a) Give an advantage and disadvantage of the venturi meter compare to the orifice meter.

(2 marks)

(b) Explain the construction of a venturi meter with the aided of an appropriate sketch.

(3 marks)

(c) The mass flow rate of air at 20°C (ρ = 1.204 kg/m^3) through a 15 cm diameter duct is measured with a venturi meter equipped with a water manometer. The venturi neck has a diameter of 6 cm, and the manometer has a maximum differential height of 40 cm. Take the discharge coefficient to be 0.98, determine the maximum mass flow rate of air this venturi meter can measure.

(15 marks)

Q5 (a) Describe body forces and surface forces acting on a control volume. Give an example for each forces with the aided of appropriate sketches.

(6 marks)

(b) Water flows steadily through a reducing pipe bend as shown in **Figure 5 (b).** Known condition are p_1= 350 kPa, d_1= 25 cm, v_1= 2.2 m/s, p_2= 120 kPa and d_2= 8 cm. Neglecting bend and water weight, estimate the total force that must be resisted by the flange bolt.

(14 marks)

Q6 (a) What is the difference between a dimension and a unit? Give one (1) example of each.

(4 marks)

(b) A human-powered submarine has to be produced for a design competition. The overall length of the prototype submarine is 2.24 m, and it is expected to travel fully submerged through freshwater at 0.560 m/s at T = 15°C. A one-eighth scale model is to be built and tested in the wind tunnel as shown in **Figure Q6 (b)**. A shield surrounds the drag balance strut so that the aerodynamic drag of the strut itself does not influence the measured drag. The air in the wind tunnel is at 25°C and at standard atmosphere pressure. Determine the air speed that wind tunnel need to be run in order to achieve similarity.

Take, for water at T = 15°C and atmospheric pressure, ρ = 999.1 kg/m^3 and μ = 1.138 × 10^{-3} kg/ms. For air at T = 25°C and atmospheric pressure, ρ = 1.184 kg/m^3 and μ = 1.849 × 10^{-5} kg/ms.

(4 marks)

(c) When fluid in a pipe is accelerated linearly from rest, it begins as laminar flow and then undergoes transition to turbulence at a time t_{tr} which depends upon the pipe diameter D, fluid acceleration a, density ρ, and viscosity μ. Arrange this into a dimensionless relation between t_{tr} and D.

(12 marks)

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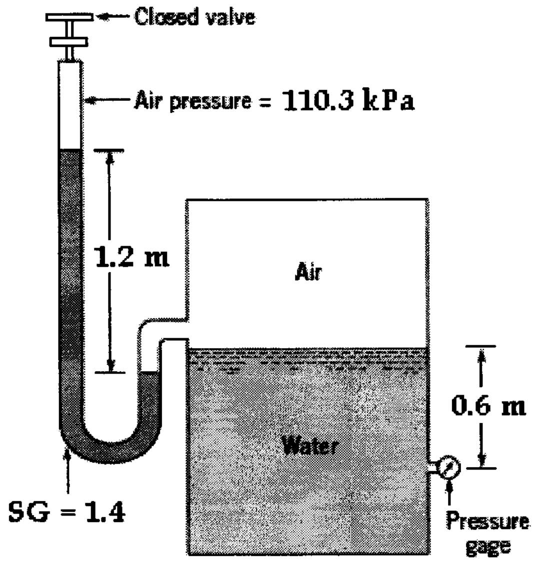

FIGURE Q1 (b)

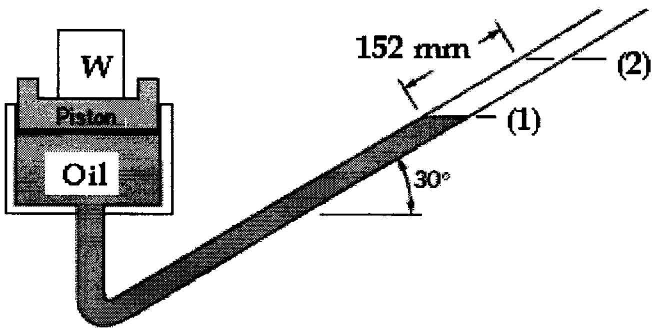

FIGURE Q1 (c)

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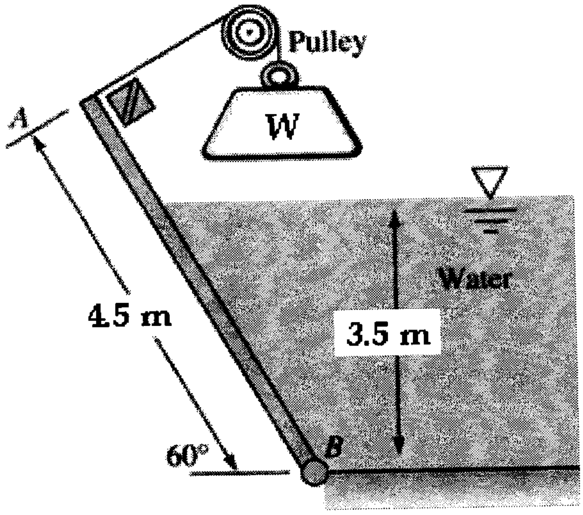

FIGURE Q2 (c)

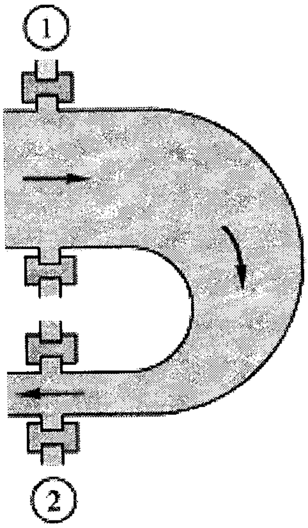

FIGURE Q5 (b)

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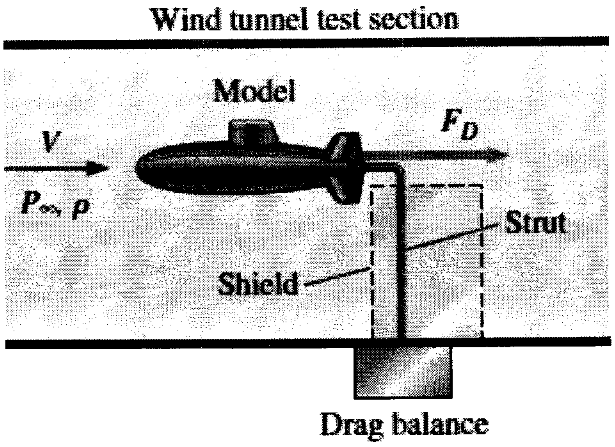

FIGURE Q6 (b)

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