Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2019/2020

COURSE NAME	:	HYDRAULICS
COURSE CODE	:	DAC 21003
PROGRAMME CODE	:	DAA
EXAMINATION DATE	:	DECEMBER 2019 / JANUARY 2020
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **FIVE (5)** QUESTIONS ONLY

THIS QUESTION PAPER CONSISTS OF **TEN (10)** PAGES

Q1 (a) Describe compressibility of liquid as a property of fluid.

(4 marks)

(b) Compare **two (2)** differences between dynamic viscosity and kinematic viscosity.

(4 marks)

(c) Capillary rise in 3 mm diameter of tube for a mercury-air-glass interface with 115°. Calculate as below:

(i) Density of mercury ($sg_{mercury} = 13.6$).

(2 marks)

(ii) Specific weight (N/m^3) of mercury.

(2 marks)

(iii) Capillary rise ($\sigma_{mercury} = 0.51$).

(2 marks)

(d) Kerosene compressed in a cylinder has a volume of 10 liters at 100 kPa and a volume of 9 liters at 500 kPa. Determine as below:

(i) Bulk modulus of elasticity (K).

(2 marks)

(ii) Initial mass of kerosene ($\rho_{kerosene} = 808\ kg/m^3$).

(2 marks)

(iii) Specific volume (m^3/kg).

(2 marks)

Q2 (a) Define transducer as a pressure measuring device.

(4 marks)

(b) Compare **two (2)** differences between simple tube manometers and differential manometers.

(4 marks)

(c) Referring to **Table 1** and **Figure Q2(c)**, inverted manometers use to measure pressure inside a pipe. Calculate as below:

(i) Pressure of $P_{x\text{-left}}$ (N/m^2).

(4 marks)

(ii) Pressure of $P_{x\text{-right}}$ (N/m^2).

(4 marks)

(iii) Pressure difference of $P_A - P_B$ (kPa).

(4 marks)

Q3 (a) Sketch the center of buoyancy and gravity location as below:

(i) When a block is partly submerged.

(2 marks)

(ii) When a block is whole submerged.

(2 marks)

(b) Describe buoyancy concept according to Archimedes Principle.

(4 marks)

(c) Referring to **Figure Q3(c)**, a 7 m width rectangular water gate leans against the floor. Determine as below:

(i) Magnitude of resultant force, F_R (N).

(5 marks)

(ii) Location of resultant force, y_R (m).

(5 marks)

(iii) Minimum force (N) required to open the water gate.

(2 marks)

Q4 (a) Compare **four (4)** differences between laminar flow and turbulent flow.

(8 marks)

(b) Referring to **Figure Q4(b)**, diameter of pipe 1 is 150 mm and diameter of pipe 2 is 75 mm. Specific gravity of oxygen in the pipe is 0.0013 and specific gravity of kerosene in the manometer is 0.808. Determine as below:

(i) Difference pressure $P_1 - P_2$ (N/m^2).

(9 marks)

(ii) Value of velocity (m/s) at point 2 if velocity at point 1 is 3 m/s.

(3 marks)

Q5 (a) Referring to **Figure Q5(a)**, describe friction in pipe as major head loss.

(3 marks)

(b) Explain the pipe system in series arrangement.

(5 marks)

(c) Referring to **Table 2**, the pipe system in parallel arrangement. Calculate as below:

(i) Velocity (m/s) of pipe 1.

(2 marks)

(ii) Velocity (m/s) of pipe 2.

(4 marks)

(d) Referring to **Table 3**, SAE 10 oil flows in a pipe. Calculate as below:

(i) Reynolds Number, R_e.

(3 marks)

(ii) Head loss (m) due to friction, h_f.

(3 marks)

Q6 (a) Weir is a concrete structure which is constructed across the open channel to change its water flow characteristics. Discuss the characteristics of weir as below:

(i) Rectangular weir.

(2 marks)

(ii) Triangular weir.

(2 marks)

(iii) Trapezoidal weir.

(2 marks)

(iv) Sharp-crested weir.

(2 marks)

(b) Referring to **Table 4**, the type of weir is rectangular notch weir. Calculate as below:

(i) Coefficient of discharge.

(2 marks)

(ii) Discharge (m^3/s) over the rectangular notch weir.

(2 marks)

(iii) Volume (m^3) of water flow over the rectangular notch weir in a week.

(2 marks)

(c) Triangular notch weir is having angle 10° and discharge over the notch is 57 X 10^5 cm^3/min. Determine the height (mm) of water level above the bottom of the notch weir when discharge coefficient is 0.59.

(6 marks)

Q7 (a) Compare **two (2)** differences between flow in open channel and flow in closed channel.

(4 marks)

(b) Explain the types of flow as below:

(i) Subcritical flow.

(2 marks)

(ii) Supercritical flow.

(2 marks)

(c) Water flows inside a culvert. Radius of the culvert is 1.2 m and height of the water flows in the culvert is 1.6 m. Determine as below:

(i) Wetted area (m^2).

(2 marks)

(ii) Wetted perimeter (m).

(2 marks)

(iii) Hydraulic radius (m).

(2 marks)

(d) Referring to **Table 5**, analyze the state of flow based on Froude Number.

(6 marks)

- END OF QUESTIONS -

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Table 1

Item	Value
ρ_a	1000 kg/m^3
ρ_{air}	1.23 kg/m^3
h_1	25 mm
h_2	50 mm
h_3	80 mm

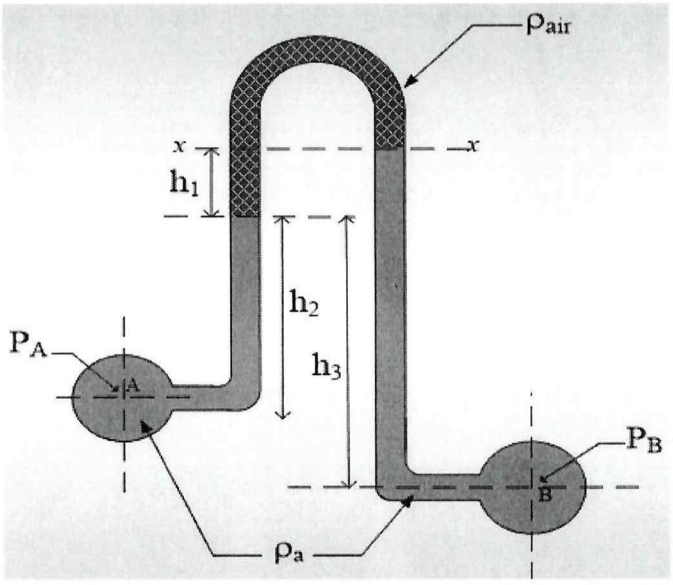

Figure Q2(c)

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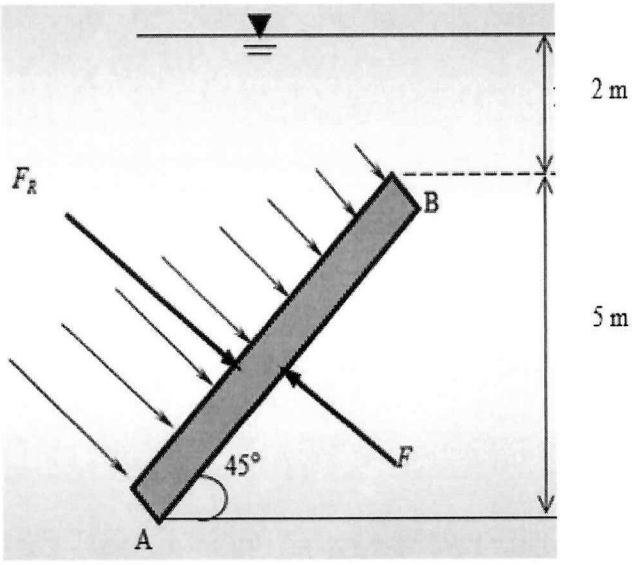

Figure Q3(c)

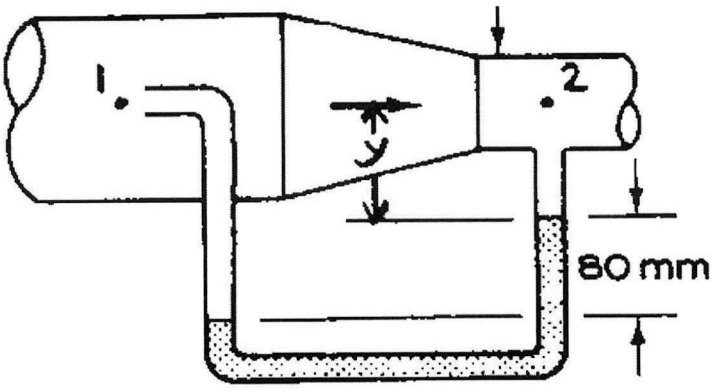

Figure Q4(b)

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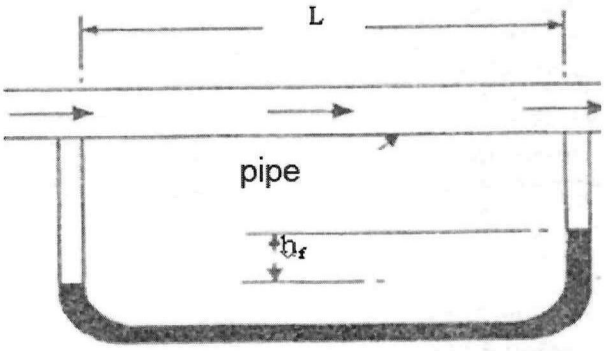

Figure Q5(a)

Table 2

Item	Value
Length of pipe 1	3 m
Length of pipe 2	9 m
Diameter of pipe 1	350 mm
Diameter of pipe 2	350 mm
Discharge of pipe 1	3000 liter/s
Value of friction factor	0.015

Table 3

Item	Value
Density of SAE 10 oil	918 kg/m^3
Dynamic viscosity of SAE 10 oil	82 X 10^{-3} kg/ms
Velocity of SAE 10 oil	0.3 m/s
Diameter of pipe	50 cm
Length of pipe	135 m

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Table 4

Item	Value
Width of weir	15 m
Head over sill	750 mm
Height of crest	3 m

Table 5

Item	Value
Top width of water surface	2.263 m
Wetted area	3.10 m^2
Wetted perimeter	4.59 m
Flow rate	1.5 m^3/s