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SULIT

POLITEKNIK MALAYSIA

BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK
KEMENTERIAN PENDIDIKAN TINGGI

JABATAN KEJURUTERAAN AWAM

PEPERIKSAAN AKHIR

SESI JUN 2017

DCC5143 : FLUID MECHANICS

TARIKH : 01 NOVEMBER 2017
TEMPOH : 2.30 PETANG – 4.30 PETANG (2 JAM)

Kertas ini mengandungi **SEBELAS (11)** halaman bercetak.
Bahagian A: Struktur (2 soalan)
Bahagian B: Struktur (4 soalan)
Dokumen sokongan yang disertakan : Formula

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

SECTION A : 50 MARKS

BAHAGIAN A : 50 MARKAH

INSTRUCTION:

This section consists of **TWO (2)** structured questions. Answer **ALL** questions.

ARAHAN :

*Bahagian ini mengandungi **DUA (2)** soalan berstruktur. Jawab **SEMUA** soalan.*

QUESTION 1

SOALAN 1

CLO1
C1

(a) Define fluid and list **FOUR (4)** categories of fluids.

*Takrifkan bendalir dan senaraikan **EMPAT (4)** kategori bendalir.*

[5 marks]

[*5 markah*]

CLO1
C2

(b) Calculate the absolute water pressure at the depth of 4m below the surface of water. Take atmospheric pressure 101.3 kN/m^2.

Kirakan tekanan mutlak air pada kedalaman 4m di bawah permukaan air. Ambil tekanan atmosfera 101.3 kN/m^2.

[6 marks]

[*6 markah*]

CLO1
C3

(c) Figure A1 shows a differential manometer. The liquid of M and N is oil (S.G= 0.8) and the specific gravity of mercury is 13.6, calculate the difference of pressure between pipe M and N if h_1=100cm, h_2=60cm and h_3=20cm.

Rajah A1 menunjukkan satu manometer kerbeza. Cecair M dan N ialah minyak (S.G= 0.8) dan graviti tentu bagi merkuri ialah 13.6, kirakan perbezaan tekanan di antara paip M dan N jika h_1=100cm, h_2=60cm and h_3=20cm.

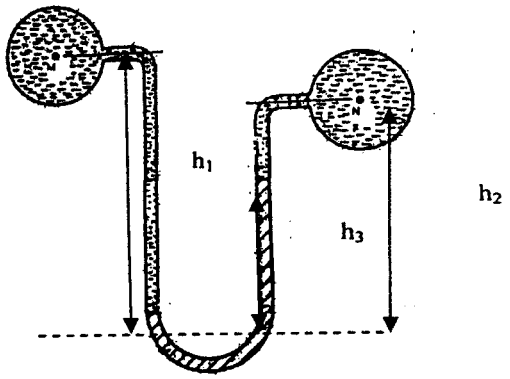

Figure A1 / *Rajah A1*

[14 marks]
[*14 markah*]

QUESTION 2
SOALAN 2

CLO2 C1

(a) Identify the height of centroid and the centre of pressure for objects immersed in liquid:
Kenalpasti ketinggian pusat sentroid dan pusat tekanan yang tenggelam dalam bendalir bagi objek:

i. Rectangular
Segiempat

ii. Triangle
Segitiga

iii. Circle
Bulatan

iv. Semicircle
Semibulatan

[4 marks]
[*4 markah*]

CLO2
C2

(b) A circular plate of 3.2 m diameter is placed vertically in water so that the centre of the plate is 3.8 m below the free surface. Determine the total force on the plate and the depth of pressure of force. Refer Figure A2(a).

Sebuah plat bulatan yang berdiameter 3.2 m berada dalam keadaan tegak di dalam air yang mana pusat bulatan berada 3.8 m di bawah permukaan air. Tentukan jumlah daya yang dikenakan terhadap plat dan juga kedalaman tekanan daya tersebut. Rujuk Rajah A2(a).

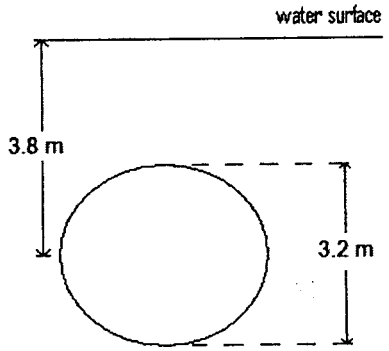

Figure A2(a) / *Rajah A2(a)*

[9 marks]
[*9 markah*]

CLO2
C3

(c) An iron plate with a diameter of 150 cm placed in water as shown in Figure A2(b), whereby the vertical distance from the water surface to the perimeter of the plate is 85 cm and 175 cm. Calculate the total force acting on the plate and calculate the vertical distance of the center of pressure from the water surface.

Satu plat besi berbentuk bulat bergaris pusat 150 cm diletakkan di dalam air seperti Rajah A2(b) di mana jarak pugak dari permukaan air ke perimeter plat adalah 85 cm dan 175 cm. Kirakan jumlah daya tekanan yang bertindak ke atas kepingan itu dan kirakan jarak pugak bagi pusat tekanan dari permukaan air.

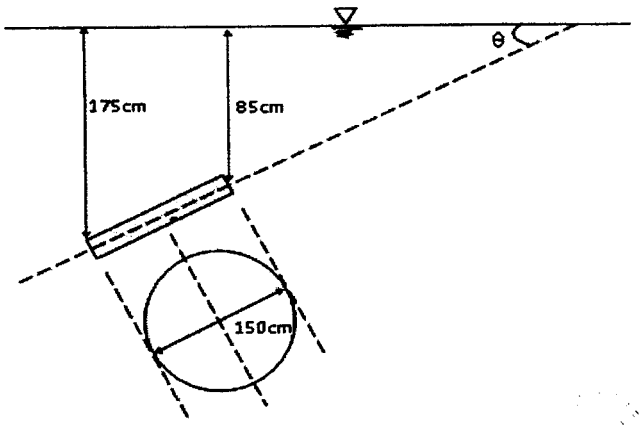

Figure A2(b) / *Rajah A2(b)*

[12 marks]

[*12 markah*]

SECTION B : 50 MARKS

BAHAGIAN B : 50 MARKAH

INSTRUCTION:

This section consists of **FOUR (4)** structured questions. Answer **TWO (2)** questions only.

ARAHAN :

*Bahagian ini mengandungi **EMPAT (4)** soalan berstruktur. Jawab **DUA (2)** soalan sahaja.*

QUESTION 1

SOALAN 1

CLO2 C2

(a) Calculate the displaced water height of a pontoon to transport vehicles across a strait of sea water with density of 1150 kg/m^3. The pontoon dimensions are 27 m long, 19 m wide and 9 m high.The weight of the pontoons is 500 x 10^{3}kg.

Kirakan ketinggian air yang disesarkan sebuah ponton pengangkut kenderaan yang merentasi air laut yang berketumpatan 1150 kg/m^3.Ponton tersebut berukuran 27 m panjang, 19 m lebar dan 9 m tinggi.Berat ponton tersebut 500 x 10^{3}kg.

[10 marks]

[*10 markah*]

CLO2 C3

(b) A cylindrical buoy with 1.8 m diameter and 2.5 m long, with the weight of 10kN. Calculate the metacentric height of the buoy to prove that it cannot float vertically in sea water. Density of sea water is 1025 kg/m^3.

Sebuah boya berbentuk silinder dengan diameter 1.8 m dan panjang 2.5 m dengan berat keseluruhan 10 kN. Kirakan ketinggian pusat meta untuk membuktikan silinder tersebut tidak dapat terapung. Ketumpatan air laut 1025 kg/m^3.

[15 marks]

[*15 markah*]

QUESTION 2

SOALAN 2

CLO2
C2

(a) i. Interpret Continuity Equation.

Tafsirkan Persamaan Keterusan.

[3 marks]

[*3 markah*]

ii. Water flows through pipe A of 1.2 m at 4 m/s and then passes through pipe B with a diameter of 0.9 m as shown in Figure B2(a). Calculate the velocity and flow rate at pipe B using Continuity equation.

Air mengalir melalui paip A 1.2 m pada 4 m/s dan kemudian melalui paip B diameter 0.9 m seperti yang ditunjukkan dalam Rajah B2(a). Kirakan halaju dan kadar alir di paip B menggunakan Persamaan keterusan.

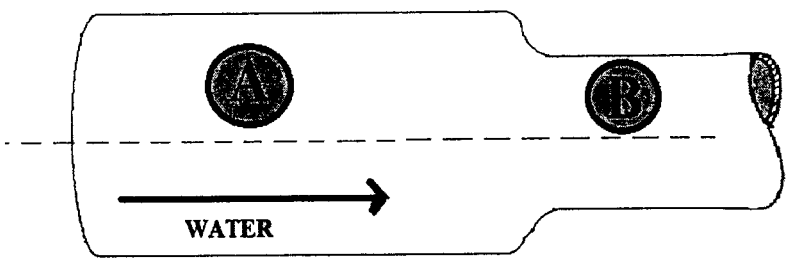

Figure B2 (a) / *Rajah B2 (a)*

[7 marks]

[*7 markah*]

CLO2
C3

(b) A horizontal venturimeter with inlet and throat diameters 300mm and 180mm respectively is used to measure the flow of water. The reading of differential manometer connected to the inlet and the throat is 7cm of mercury. Based on Figure B2(b) calculate the flow rate. ($C_d = 0.98$).

Satu venturimeter mendatar dengan inlet dan leher masing-masing berdiameter 300mm dan 180mm digunakan untuk mengukur kadaralir. Bacaan merkuri manometer kebezaan yang disambungkan ke bahagian masuk dan leher adalah 7cm. Berdasarkan Rajah B2(b) kirakan kadaralir. ($C_d = 0.98$)

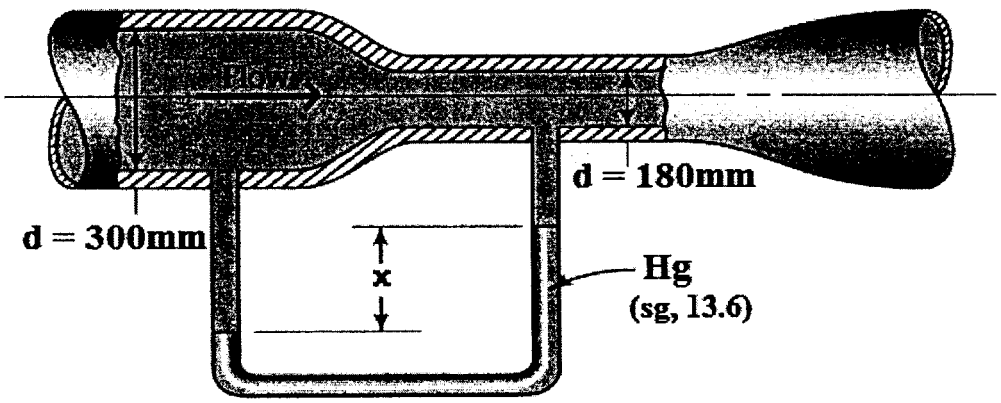

Figure B2 (b) / *Rajah B2 (b)*

[15 marks]

[*15 markah*]

QUESTION 3

SOALAN 3

CLO1
C2

(a) i. Calculate the energy loss due to friction in the 55000 cm length of pipe and diameter of 120 mm when the flowrate is 1.65 m^3/min. Given friction factor, f = 0.015.

Kirakan kehilangan tenaga kerana rintangan geseran dalam paip 55000 cm panjang dan bergarispusat 120 mm apabila kadaralir adalah 1.65 m^3/min. Diberi faktor geseran, f = 0.015.

[4 marks]

[*4 markah*]

ii. Based on Figure B3(a), calculate the minor energy losses of flow due to a sudden enlargement of a pipe when the flowrate is 0.25 m^3/s.
Berdasarkan Rajah B3(a), kirakan kehilangan tenaga kecil aliran yang melalui paip membesar secara mendadak, jika air mengalir pada kadar 0.25 m^3/s.

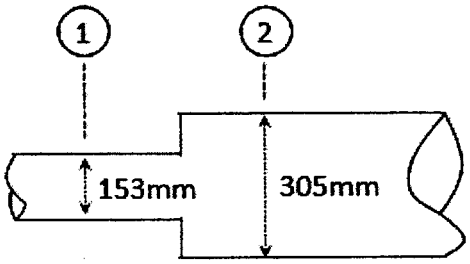

Figure B3(a)/Rajah B3(a)

[6 marks]
[6 *markah*]

CLO1 C3

(b) A large water tank supplies water into another tank through a pipe of 2200 m length and a diameter of 160 mm as shown in Figure B3(b). The height difference of the water level in both tanks is 18 m.
Satu tangki air besar menyalurkan air ke dalam satu tangki lain melalui sebatang paip yang panjangnya 2200 m dan diameter 160 mm seperti Rajah B3(b). Perbezaan ketinggian paras air di kedua-dua tangki ialah 18 m.

i. Considering all the head losses, calculate the water flowrate in the pipe if friction coefficient, f = 0.008.
Dengan mengambil kira kesemua kehilangan turus, kirakan kadaralir air dalam paip jika pekali geseran, f = 0.008.

ii. Calculate the pressure at point X at a distance of 1650 m from the entrance pipe of tank A and the height of that point to the water level of tank A is 22 m.
Kirakan tekanan pada titik X pada jarak 1650 m dari ruang masuk paip tangki A dan ketinggian dari titik tersebut ke paras air tangki A ialah 22 m.

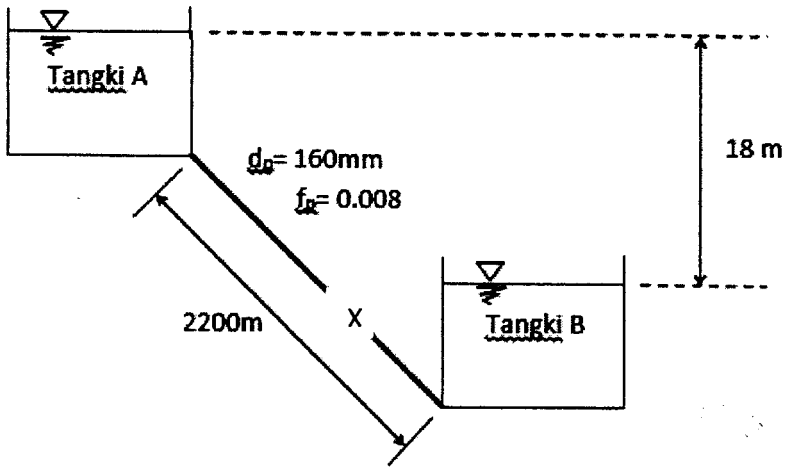

Figure B3(b)/Rajah B3(b)

[15 marks]

[*15 markah*]

QUESTION 4

SOALAN 4

CLO2
C1

(a) Explain clearly the Newton's second law of motion and the equation involved.
Takrifkan dengan jelas Hukum Newton Kedua dan persamaan yang terlibat.

[4 marks]

[*4 markah*]

CLO2
C2

(b) A water jet with a diameter of 10cm strikes a flat plate with the velocity of 20 m/s. Determine the force on the plate:
Jet air berdiameter 10 cm menghentam plat rata dengan kelajuan 20 m/s. Tentukan daya pada plat:

i. If the plate is static.
Jika plat berada dalam keadaan pegun.

ii. If the plate is moving with a velocity of 10 m/s away from the jet.
Jika plat bergerak dengan halaju 10 m/s menjauhi jet.

iii. If the plate is inclined at the angle of 20° to the axis of the jet.
Jika plat yang condong 20° dengan paksi jet.

[9 marks]
[*9 markah*]

CLO2
C3

(c) A water jet with a diameter of 70 mm is deflected by 60° at the velocity of 36 m/s at the beginning of the blade as shown in Figure B4. Calculate the magnitude of the force generated by water on the blade when the velocity of water jet leaving the blade is 30 m/s due to friction.
Suatu jet air yang mempunyai diameter 70 mm dipesongkan pada sudut 60° dengan kelajuan 36 m/s pada permukaan bilah seperti yang ditunjukkan pada Rajah B4. Kirakan daya paduan yang terhasil apabila kelajuan jet air meninggalkan bilah adalah 30 m/s yang disebabkan oleh geseran.

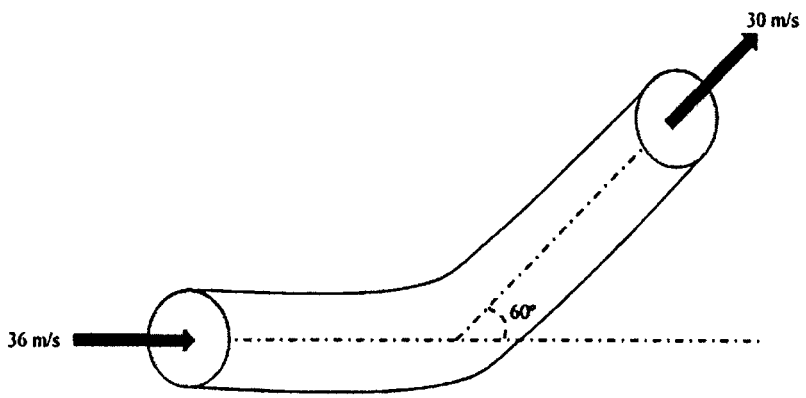

Figure B4 / *Rajah B4*

[12 marks]
[*12 markah*]

SOALAN TAMAT

FORMULAE DCC5143 – FLUID MECHANICS

LIST FORMULAE

1. $H = z + \frac{p}{\rho g} + \frac{v^2}{2g}$

2. $Q = C_d A \sqrt{\frac{2gH}{m^2-1}}$

3. $Q = C_d \, x \, ((A_1 A_2)/\sqrt{(A_1^2 A_2^2)}) \, x \, \sqrt{2gh}$

4. $H = hm \left(\frac{\rho_m}{\rho} - 1\right)$

5. $Q = C_d A_o \sqrt{2gH}$

6. $C_d = C_v \, x \, C_c$

7. $C_v = \sqrt{\frac{x^2}{4yh}}$

8. $h_L = k\left(\frac{v^2}{2g}\right)$

9. $h_L = k\frac{[(v_1 - v_2)^2]}{2g}$

10. $h_L = \left(\frac{1}{C_c} - 1\right)^2 \frac{v^2}{2g}$

11. $h_{fL} = \frac{4fL}{d}\frac{v^2}{2g} = \frac{fLQ^2}{3d^5}$

12. $C_v = \frac{V_{actual}}{V_{theory}}$

13. $C_c = \frac{A_j}{A_o}$

14. $P = \rho g h$

15. $Q = Av$

16. $F_x = \rho g A \hat{y}$

17. $F_y = \rho G v$

18. $h_p = \hat{y} + \frac{I_{cg} \sin^2\theta}{A\hat{y}}$

19. $MG = BM - BG$

20. $BM = \frac{I_{xx}}{V_d}$

21. $F = \rho A v^2$

22. $F = \rho A (v-u)^2 \, kos \, \theta$

23. $F = \rho A (v-(u/kos\,\theta))\,(vkos\,\theta - u)$

24. $F_x = \rho Q (v_{x1} - v_{x2})$

25. $F_y = \rho Q (v_{y1} - v_{y2})$